JOURNAL
of
FARM ECONOMICS
Volume XXXVI
1954

Published by
THE AMERICAN FARM ECONOMIC ASSOCIATION

PRINTED BY THE GEORGE BANTA PUBLISHING COMPANY

JOURNAL of FARM ECONOMICS

CONTENTS

THE AMERICAN FARM ECONOMIC ASSOCIATION

Volume XXXVI FEBRUARY, 1954 Number 1

CONTENTS *(Continued)*

Price: $5 per year, this issue $1.25

Entered as second class matter at the post office at Menasha, Wis. Acceptance for mailing at a special rate of postage provided for in the Act of February 28, 1925, paragraph 4, section 412, P. L. & R., authorized November 27, 1931. Printed in U.S.A.

THE JOURNAL OF FARM ECONOMICS is published five times a year during February, May, August, November and December by The American Farm Economic Association. Yearly subscription $5. Published at Menasha, Wisconsin.

Va

th
of
Ag
th
Se
m
in
De

I
ce
ca
of
m
th

th

Bus Adm.
Fapon

JOURNAL OF FARM ECONOMICS

Volume XXXVI FEBRUARY, 1954 Number 1

THE FRAGMENTATION OF THE BAE

(On November 2, 1953 Secretary Benson put into effect a reorganization of the U. S. Department of Agriculture. The new organization splits the Bureau of Agricultural Economics into four parts with one part transferred to the Agricultural Research Service in the new Federal-States Relations group and three parts going to separate divisions of the new Agricultural Marketing Service. Because of the importance of this change to many agricultural economists the following symposium has been organized. The May issue is planned to include a discussion of changes in the organization and functioning of the Department as a whole.–*Editor's note.*)

CHIEFS OF BUREAU OF AGRICULTURAL ECONOMICS

H. C. Taylor–July 1, 1922-Aug. 15, 1925
Thomas P. Cooper–Sept. 1, 1925-June 10, 1926
Lloyd S. Tenny–Dec. 23, 1926-July 16, 1928
Nils A. Olsen–July 16, 1928-April 15, 1935
A. G. Black–April 15, 1935-Oct. 6, 1938
Howard R. Tolley–Oct. 6, 1938-May 15, 1946
O. V. Wells–May 16, 1946-Nov. 2, 1953

AGRICULTURAL ECONOMICS UNDER THE USDA REORGANIZATION OF NOVEMBER 2, 1953[1]

O. V. Wells
Agricultural Marketing Service

IN RESPONSE to the editor's invitation for comments on the recent reorganization of the USDA I shall endeavor to briefly consider certain basic decisions or general principles which were followed, to indicate the manner in which functions formerly performed by the Bureau of Agricultural Economics have been reallocated and to offer some comments as to possible effects of the changes made, with some reference to the objections which have been most commonly advanced.

[1] The views expressed are those of the author personally and not necessarily those of the U. S. Department of Agriculture or any official agency thereof.

I

In considering the November 2 reorganization, it seems to me there were three general decisions or underlying principles which activated the Secretary's Reorganization Committee or group. These were:

(1) *The decision to make lines of authority as clear, with as little overlapping or "double layering," as possible, while at the same time keeping the span of control or number of people reporting at each level of authority within a reasonable working limit.*

That is, all program activities within the Department were brought together under four general groups reporting to the Secretary through three assistant secretaries and an Assistant to the Secretary for Credit. The activity fields assigned to each of the assistant secretaries are in turn organized into a series of general "Services" or "Administrations," of which agricultural economists are most especially interested in the Agricultural Marketing Service and the Agricultural Research Service.

(2) *The decision to organize the various Services or program agencies in such a way as to provide for a concerted or team attack on certain broad problem areas facing farmers and businesses handling farm products rather than around particular commodities* (as were the commodity branches of the old Production and Marketing Administration) *or around particular academic disciplines* (as was the case with the Bureau of Agricultural Economics and the other old-line bureaus in the Agricultural Research Administration).

Under the new assignments, the Agricultural Research Service is designated as the Departmental agency for production and utilization research and related services, while marketing and distribution activities are assigned to the Agricultural Marketing Service, with price support, acreage allotment, marketing quota, and related activities assigned to the Commodity Stabilization Service (formerly the Production and Marketing Administration).

In connection with these assignments, the Agricultural Research Service will be responsible for research in the fields of crop and animal production, farm and land management, human nutrition and home economics, and utilization, as well as for the coordination of all research, and a wide range of service activities having to do with meat inspection, animal diseases, plant quarantine, and insect control.

The Agricultural Marketing Service will be responsible for all marketing research (whether economic, engineering, or biological), for general statistical analysis and agricultural economic research, for crop and livestock estimates, and the coordination of all statistical activities, along with a wide range of marketing services, including market news, grading and inspection, and the administration of various regulatory acts, marketing

agreements for fruits and vegetables, and programs developed under Section 32 and the School Lunch Act.

(3) *The decision to adopt a uniform nomenclature which not only starts with the use of the overall term "Service"* (or in the case of the credit agencies, "Administration") *for the larger aggregation but which also gives units and individuals performing similar functions the same descriptive titles, including the elimination of all the old bureau names.* That is, each "Service" breaks down into a series of "divisions" which are approximately equal to the former bureaus in the Agricultural Research Administration, the fields covered by the three assistant chiefs of the Bureau of Agricultural Economics, and the main branches of the Production and Marketing Administration.

II

Precisely what happens to the various functions formerly performed by the Bureau of Agricultural Economics?

The Assistant Chief for Production Economics along with all work relating to farm management and costs, land economics, and agricultural finance are transferred to the Farm and Land Management Division of the Agricultural Research Service where the most of this work will be organized in a production Economics Branch.

All marketing and transportation research, including work carried on under Title II of the Research and Marketing Act, is transferred to the Marketing Research Division, Agricultural Marketing Service; the Assistant Chief for Prices and Income, along with statistical and historical research and work on farm population and rural welfare, are transferred to the Agricultural Economics Division, Agricultural Marketing Service; and the Assistant Chief for Agricultural Estimates, along with the entire crop and livestock estimates staff including the State statisticians, are transferred to the Agricultural Estimates Division, Agricultural Marketing Service.

III

It seems to me that the arrangements discussed above offer agricultural economists more opportunity for research and program assistance within the USDA than any other form of organization which has been seriously advanced over the last several years, always provided of course that their abilities and leadership are equal to the task.

Agricultural economists and statisticians are given responsible roles within the research and statistical sectors of both the Agricultural Research and Agricultural Marketing Services (as well as in the Farmer Cooperative Service, formerly the Cooperative Research and Service Division of the

Farm Credit Administration, which will now work directly under the Assistant Secretary for Federal-States Relations inasmuch as the Farm Credit Administration became an independent agency as of December 4, 1953).

However, there have been a number of questions raised about the reorganization by agricultural economists and others, revolving chiefly around two main points: (1) that the objectivity of economic and statistical research may suffer from being too closely associated with "action" programs, including the possibility that the new arrangements could lead to overemphasis on short-run or service research at the expense of basic or longer-run research, and (2) that the farm management and land use research transferred to the Agricultural Research Service should not be separated from the general economic research and related statistical work transferred to the Agricultural Marketing Service but rather that the two types of work could be more effectively carried on within a single division or work group.

I am sure that the Secretary's Reorganization Committee was aware of these two points and considered them at some length. I have already endeavored to indicate that the basic decision was to organize around main problem areas rather than around academic disciplines—to in effect organize groups or teams composed of whatever scientific and research personnel might seem most appropriate along with those in charge of the related service activities. This has meant the discontinuance of all the old-line bureaus together with the reassignment of their work on the new functional basis. Certainly there is much to be said for this bringing together of the scientific disciplines necessary to attack a particular problem and I think it not only holds promise of improved service to farmers generally but also of some most interesting possibilities at the research level.

Perhaps there would not be much disagreement among agricultural economists as to the above considerations if we were concerned only with service or short-run research. But how about the question as to objectivity and the problem of maintaining basic or long-run research?

This is a difficult question to discuss since on the one hand it comes fairly close to calling for a consideration of the nature of genius and how it may best be nurtured while on the other it obviously deals with administrators as men—their training, their allegiances, and the goals toward which their main efforts are likely to be chiefly directed.

Perhaps the essential crux of this question lies in a recent statement by Andre Malraux, who somewhere in his *Voices of Silence* observes: "I name that man an *artist* who *creates* forms . . .; and I call that man an *artisan* who *reproduces* forms, however great the charm or sophistication of his craftsmanship." But having gotten this far, Malraux hastens to

develop the argument from which he never long departs—that is, that the real theorists, those who create new art forms or in our terms, those who may be able to do basic research that is worth while, must somehow, somewhere, someplace, get acquainted with the facts and materials of which they eventually become the master.

Surely the argument that one can assure first quality basic or long-run economic research by some simple organizational device is open to considerable question entirely aside from the very difficult problem of financing, especially within the framework of annual appropriations where the question is and must be continually raised as to the relevance and eventual usefulness of such research. Meanwhile economic theory itself, certainly the classical economics of the West, owes as much to individuals who were closely associated with what was going on in business and Government as to any other class, as exemplified by contributions of one kind or another from Ricardo to Keynes as well as by the rise of the agricultural economists within the U.S.

There is one final idea which I should like to advance. That is, it seems to me that the reorganization does place some greater responsibility upon the Departments of Agricultural Economics in the land-grant colleges and universities and upon the American Farm Economic Association for defining and maintaining the integral character of agricultural economics than has been the case over most of the time since the Bureau of Agricultural Economics was organized on July 1, 1922. At the same time I also feel that the Secretary's Reorganization Committee has in effect developed a series of arrangements which offer wider opportunities for more agricultural economic students or graduates, including not only the specialists but also those who look upon the whole of agricultural economics as falling within their field.

IMPROMPTU COMMITTEE STATEMENT

The following statement, prepared by the impromptu group whose names are attached to it, can be understood properly only if the circumstances under which it was prepared are known. This group met in Washington for the one day of October 26 and interviewed those who would be most responsible for the decision or most concerned with it and then sat down and agreed with each other as to what should go into the statement. It decided to limit the statement in the main to one specific proposal which it concluded was the most that had any chance of being accepted. It became very evident to them that Secretary Coke and those who had worked out the proposed reorganization were strongly sold on it, and would accept no sweeping departures from it no matter how strong the objections raised. It was also apparent that the top men in the BAE had already accepted it—"sold out to it," no doubt some will say.

Even this limited proposal apparently received little consideration. Probably it would have received more except for the attack on the proposed reorganization by the Soil Conservation officials group. The USDA top officials, apparently with the President's approval, decided to stop this at once by going ahead with

the reorganization as previously laid out. They met on Sunday, November 1, and put together the statement that was released to the press at 9:00 the next morning.

The first three of the impromptu group are members of the Committee on Agriculture of the National Planning Association, which met for other purposes at Chicago, October 17-18. The agricultural economists on the Committee presently found themselves discussing intently how the proposed reorganization of the USDA would affect research in the social sciences as they relate to agriculture. In the end, they proposed to the Committee the inviting of Professor Cowden as the President of the American Farm Economic Association and Dean Whetten of the University of Connecticut as President of the Rural Sociology Association to meet with them in Washington for the day to learn more explicitly the nature of the reorganization proposals and to recommend modifications if any seemed to them advisable.—JOHN D. BLACK

The Statement

Reasons for Suggested Modifications

1. The great need for a strong program of fundamental longer-run research—as distinguished from operations and program research pointed directly at immediate improvement of action, service and regulatory work. This is as important in the social sciences as it is in the natural sciences.

2. The need for having this research carried on in a research unit removed from the action, service and regulatory work, to preserve its objectivity and freedom from pressures.

3. The keeping of farm management research within agricultural economics. Historically it got started as a separate department from agricultural economics in many of the land-grant colleges, and only in this last year did the last one of them bring the two together in one department. A major weakness of farm management research in the past has been its failure to be developed in terms of the economics of production, resource use, price and income. The proposed reorganization would be in the direction of separating them again.

4. Given an Agricultural Economics unit of the sort suggested herein, research in agricultural economics in the USDA will have a high professional standing, will attract men of first-rate ability, and appeal to young men in training.

Suggested Modifications

1. *That the three units in the present BAE now proposed to be transferred to the Research and Statistical Service under Agricultural Marketing Service—namely, Statistical and Historical Research, Farm Income, and Farm Population and Rural Life—instead be transferred to Agricultural Research Service.*

2. *That these three units be combined with the three units in the present BAE now named Farm Management, Land Economics, and Farm*

Finance, to form a branch of the Agricultural Research Service that had best be called Agricultural Economics Research.

The two foregoing suggested modifications represent the core of what seems to be needed by the five submitting this statement. The three following are in nature suggested ways of implementing Numbers 1 and 2.

3. If the present status of agricultural economics research as coordinate with that in the natural sciences in the ARA is continued, the administrative unit of the ARS handling research in the economics of agriculture and sociology of rural life would constitute a unit coordinate with Natural Sciences. The six units named above could, however, be grouped under three or four heads, such as:

Division of Farm, Land and Range Management
Division of Markets, Prices and Income
Division of Farm Population and Rural Life
Division of Farm Finance

It would still be possible to include Soils and Water Conservation and Agricultural Engineering in the Division of Farm, Land and Range Management. But integration of farm management and land use generally with Crop Research and Livestock Research is as essential as with Soils and Water Conservation and Agricultural Engineering. It is suggested that the needed integration might be as well or better obtained by setting up cross-Division groups, from both the Natural Sciences unit and the Agricultural Economics unit, to handle particular undertakings. Such integration might be further facilitated if a Division were set up under the Natural Science unit with a name parallel with Farm, Land and Range Management, this to include the natural science work in soils and water conservation and agricultural engineering, and possibly also some other natural science work needing to be integrated with farm and land management.

4. The research in farm labor, under this setup, would be left as now in Farm Population and Rural Life, but would be closely integrated with Farm, Land and Range Management.

5. Similar integration of the work in the several Divisions in Agricultural Economics Research would be needed with the Home Management section of the proposed Division of Nutrition and Home Management, since Home Management is as much economics as is Farm Management. It also involves in large measure the sociology of rural life. The alternative to this could of course be to put Home Management under Agricultural Economics, but this would not be wise for several reasons.

All of us want it clearly understood that we do not underrate the need for operations and program research in the field of marketing of farm

products. We would like to see such research given a unified organization and strengthened in the proposed Agricultural Marketing Service. The research of this type now being done in PMA plus that now being done in the BAE furnish a substantial core and foundation for it.

JOHN D. BLACK, Harvard University
THEODORE W. SCHULTZ, University of Chicago
FRANK J. WELCH, University of Kentucky
THOMAS K. COWDEN, Michigan State College
NATHAN L. WHETTEN, University of Connecticut

AN ADMINISTRATIVE VIEW

PAUL H. APPLEBY
Syracuse University

THERE are, I suppose, three principal ways in which to consider a particular reorganization. One is in terms of past shortcomings. One is in relation to new needs or new policy. And one is in relation to organizational theory derived from study of and experience in such matters. The three kinds of concerns consciously or unconsciously enter into any involved change in structure and weigh variously in appraisal of such change.

In the thirties I had something to do with a Department of Agriculture reorganization in which we tried to make the Bureau of Agricultural Economics *the* over-all, technical program-planning agency of the Department. We conceived of social research and program planning as inextricably intertwined and as constituting a continuum—or two continua. We saw research and planning go hand in hand with operations of the Soil Conservation Service, for example, when a visit to any field of operations disclosed more or less conscious experimentation, appraisal and learning applied in methods modified on successive tracts of land. We saw research and planning of more conscious sort on a broader basis in the Research Division of the Soil Conservation Service, on a still broader basis in the Bureau of Agricultural Economics, and on a still broader basis in the old National Resources Planning Board.

Our sense of need at that time pointed to more common learning, more advanced learning, dissemination of learning, coordination, and top-level policy guidance. To maximize the advancement of efforts in various operating bureaus and to provide more insights and better insights in the Secretary's Office, our sense of need had a *departmental* character. To put the Bureau of Agricultural Economics in a position of impartiality, freeing it from any competitive relationship to operating agencies, we removed from it the regulatory activities it had carried on.

After the reorganization, the Bureau continued, we felt, to make with

success and distinction the kinds of strictly economic studies it had been conducting for a good many years. It did provide new stimulation and orientation for the operating bureaus. Informally, it achieved a considerable amount of greater coordination of programs in the counties. It did not prove as useful to the Secretary's Office as we had hoped.

This one adverse judgment requires extended exploration. In the space here available the discussion must be sketchy. The relative failure at the level of the Secretary's Office turned on two things. First of all, the Bureau provided little material directly equipping the Secretary to say in a public speech or to a Congressional committee anything dramatic or incisive about just how the various programs would, should or could be modified "next year." Secondly, when we wanted the incisive and concentrated wisdom of the entire Bureau concerning some problem there was relatively little use of hierarchy in distilling and translating specialized knowledge into terms readily relatable to other considerations. Instead, we were likely to get a memorandum written by a single specialist, transmitted through a Section head to a Division head, thence to the Chief of Bureau, thence to the Secretary.

It must be said that we got more distilled and transformed institutional wisdom than we had received before the reorganization, yet much less than we desired. Institutional, social and political wisdom are not synonomous with "expert knowledge," but result from the interaction of facts and functions, experts and non-experts. The systematic use of such institutions as the Bureau then was, for the purpose of moving its product toward wisdom, is still little understood and hard to achieve.

The Bureau itself was not very successful with Congress, either. We had to fend for it often and vigorously, and some of our successors had to accept substantial cuts in the Bureau's appropriations.

I think the fault for all this was at least chiefly ours. After all, it was *our* sense of need that was to be served by the new structure. Undoubtedly, we did not communicate our needs adequately, and in other ways we failed to provide an adequate bridge between the Bureau and the situation of the Secretary's Office. It may be a mistake to try to channel relatively expert advice to such high levels of responsibility inevitably having general and generalizing character. In other words, it may be that advice from economists or political scientists or sociologists or anthropologists *qua* social scientists will be more effective when fed into an organization at lower levels, there incorporated with other materials and reformulated before higher transmission. Other expert groups and agencies similarly placed have been known more for their studies than for their direct contributions to decision-making. Receptivity was about as high in the Secretary's Office in the thirties as it is often likely to be, and as a usual matter perhaps other structures are indicated. On the other

hand, administrators have not very consciously or extensively experimented with ways in which to maximize the direct usefulness of such units.

This bit of reminiscence will illustrate the ways in which senses of need will arise and vary. Policy differences probably require no illustration. Some of the changes in structure now being made reflect policy attitudes different from those generally obtaining for almost two decades. We may disagree with these policies, but they are the responsibility of the Administration now in office and are to be judged, modified or upheld by political means.

Viewing the recent reorganization as independently of policy as possible, in terms of organizational and administrative theory and experience, the following judgments may be offered in a summary series, with a little discussion thereafter:

1. The Secretary's ability to control the Department is made more dependent on sanctions available to him, and less on his position at the apex of an integrated pyramid in which by structure and process his constant exercise of discretion is facilitated.

2. There is on the whole less provision for and structural dictation of interaction between parts of the department.

3. Social research and program planning are more confined to operating-agency dimensions, or less departmental in character because of being moved to a secondary, intra-Service level.

Concerning the first point, Chester Barnard in *The Functions of the Executive* has pointed to the need for having all executives on any one hierarchical level as nearly equal in power or responsibility as possible. This is a dictum that was violated by the Department during the war when the Production and Marketing Administration was set up so as greatly to overshadow other agencies. The new plan takes some research away from the Service that is successor to PMA without greatly diminishing its actual power. It leaves commodity disposal there, and leaves the PMA preoccupations dominant over the Commodity Credit Corporation. It probably magnifies that dominance.

The Secretary has two conflicting responsibilities in the commodity loan program. He must operate a lending institution in such a way as will not accumulate too inacceptable losses; he can not expect a war always to provide offsetting profits. At the same time, he must establish loan rates that will have the desired effect on farm income. The crop adjustment program is inherently an income-supporting program; the organization is inevitably a suppliant in the farmers' interest. There will be a tendency for the crop adjustment organization to seek results from the loan operation it can not support by crop adjustment. The decision-making problem that grows out of this conflict of responsibility is clearly

one that should be based on a structure designed to secure competition between two different functional responsibilities, requiring resolution at the departmental level. The announced structure tends to push this policy decision downward and to minimize competitive interplay of responsibilities. The demeaning of BAE functions contributes importantly to the same ends. In the old structure the Bureau was an important influence on loan policy.

Point one thus naturally leads into point two, for which there are other examples. The Hoover Commission accepted the theory of "coherent missions" as a general structural guide, but in the new Department plan this theory is rather curiously applied. Consolidation of rather diverse functions under assistant secretaries tends to integrate them for control purposes, and to confine interaction within the super-bureaus thus created. Consolidation is based on abstract terminology, such as "stabilization," "credit," or "federal-state relations," which may reflect little of the intrinsic characteristics of actual functions. The Farmers Home Administration, for example, should not be considered primarily in banking terms.

On point three the reorganization is not consistent. Soil conservation research is transferred *away* from operations. Range and grass management research is moved *away* from operations. Transfer of forest disease and pest research is *to* operations. The transfer of marketing research is *to* operations. The transfer of farm management and land use research is from one research agency to another. In the latter case there is a greater subordination of the transferred research, however. It is moved from the Secretary's Office staff level to a somewhat indefinite level within a single service. Unity in the abstract term "research" thus will subordinate social science to the much larger agglomeration of work in the natural sciences.

On balance, the Forest Service comes out about even, the Soil Conservation Service is loser, research in economics is broken up and subordinated but not now diminished.

It may be that this structure will make economic research less vivid and therefore less vulnerable; it may be more capable of expansion when increases in appropriations again are fashionable—or recognized to be urgently needed. And it must be said that there is no general principle which would more certainly require a government department to have a Bureau of Economics than there is one that would require a university to have a Department of Patents. In other words, government is no more to be required to organize so as to follow the structures of universities and academic disciplines than universities should be structured as replicas of government. The basic significance of economics is as an academic discipline with methods capable of producing *specialized* insights into primarily intellectual problems.

It would appear fair to say, however, that the Bureau of Agricultural Economics never showed any signs of usurping the roles of political or generalist decision-makers, and that it contributed very significantly to the workings of a large and important governmental department. The probability is that dissemination of economic research will weaken such research, not strengthen it. It would seem fair to say that the Secretary of Agriculture will be more poorly served than he has been in the past, whether he knows it or not. It may also be asserted with confidence that the Department of Agriculture has become a place much less attractive to first-rate economists. These things are of concern not only to economists.

THE REORGANIZATION OF THE ECONOMIC WORK OF THE USDA

H. C. TAYLOR

FOR thirty-two years the Bureau of Agricultural Economics served as "eyes for the farmers." It came as a shock to many of us when we heard the economic work of the U. S. Department of Agriculture was to be scattered through the four new groups into which the work of the Department has now been divided with no common denominator except the Secretary himself. However good may be his economic vision and his skill in inspiring and coordinating the economic work, no Secretary of Agriculture has time to perform this task. There is grave danger that the "eyes for the farmers" will soon be out of focus. The selection of personnel, the stimulating of an enlarging and clarifying view of the services to be rendered, the guidance and coordination of the economic research and service work of the U. S. Department of Agriculture make a heavy load for the most competent economist who has no other task.

Naturally we have asked, "Why this dismantling of an admittedly effective organization?" The answer received from Assistant Secretary J. Earl Coke, dated November 16, 1953, reads as follows: ". . . the Secretary and the Reorganization Committee . . . feel that there are some important advantages to organizing or bringing together the appropriate team of scientists or researchers to attack particular problems even though this does involve putting agricultural economists, engineers, biologists, entomologists, etc. together in the same organization. In short, the leading principle in the reorganization plan has been to look at the problems facing the farmers and the industries that handle farm products rather than the scientific background or training of the particular personnel involved."

This is a frank statement. The question is, will the service reaching

the farmer possess as high quality when the *primary* organization is based upon problems as when based upon sciences?

Problems constitute the current grist of the USDA. There are problems basic to progress and problems relating to ills. When the work is well done the problems of this year are not the problems of next year. Agriculture is carried on in a dynamic world. There is a constant flow of new problems arising out of changing conditions on farms, in markets at home and abroad, in credit conditions, in money values of things farmers sell and of things farmers buy, etc. The team organized for one problem may not be the team fitted for the next problem. The teams will need to be made up anew with each change in the character of the problems.

When the work is properly organized in a favorable environment science grows, methods of research continually improve, knowledge accumulates and enables men better and better to understand the world in which they work and live. A knowledge of the setting in which farmers operate and a knowledge of the trends of the time are essential to lighting the pathway of progress as well as to diagnosing ills. This knowledge is acquired through careful, continued, fundamental study of the forces operating in the whole national and world economy.

A department of agriculture organized around "particular problems" is in danger of letting fundamental research "fall between," and also in danger of running out of the basic background material which is essential to promoting progress in farm practices, and to understanding current problems as they come upon the scene. A department so organized is in danger of running out of men with basic training and that understanding essential to the diagnosing of ills and the blazing of new trails for progress in agriculture.

Those who organized the BAE believed the *primary* organization should be on scientific lines, with the conviction that to be able to draw well-trained men from groups carrying on fundamental research, for building up temporary teams to wrestle with specific problems would prove more effective than trying to build the primary organization around the flow of shifting problems. It was believed that men of greater ability could be secured and kept in a scientific organization than in an organization built primarily around problems. It was believed there was a larger task than that of dealing with current problems. That larger task is laying the foundations of progress.

Those who have taken the responsibility of reorganizing the USDA around "particular problems" without basic scientific organization as a primary foundation have doubtless assumed there are and will be plenty of scientific men to call upon to make up their problem teams. There may be for a time. There are now many well-trained men in the Department.

Thirty-two years ago there were many agronomists but no agricultural economists in the Bureau of Markets. The Chief was an agronomist. Crop estimates was conducted as a routine task. When the Office of Farm Management went on the rocks in 1918 it had a staff made up of agronomists, agricultural engineers, one geographer, and two agricultural economists. The difficult problem faced by the organizers of the BAE was the securing and training of men with the background knowledge to diagnose the ills that troubled the farmers and to assist farmers in their progressive undertakings. The building of economic strength into the BAE was a task of years. Staff members were sent to universities for special training. The Graduate School of the USDA was organized. The colleges were called upon for men. Gradually a staff was developed that won the respect and admiration of both scientists and farmers.

With the economic work split up and scattered, who will maintain the basic scientific research, where, in years to come, will the supply of men be found for problem teams, and who will lay the foundations of progress? Frankly it appears a road has been chosen that leads to disintegration of the scientific work and the deterioration of the application of science to the solution of farm problems and to the blazing of trails for progress.

DISMEMBERMENT OF THE BAE

HOWARD R. TOLLEY
Ford Foundation

THE announcement of the dismemberment of the 30-year old, internationally known Bureau of Agricultural Economics as a part of the general reorganization of the Department of Agriculture was not only a surprise, but a real shock. Many questions immediately came to mind.

Among them were: Why are economic information, research, and analysis being subordinated to and intermingled with engineering and soils on the production side, and with marketing services. regulatory activities, and food distribution activities on the marketing side? Is it a genuine attempt to get more consideration of economic information and analysis into the planning and administration of the action programs of the Department? Is the scope of Agricultural Economics work within the Department to be limited to the announced function of the so-called Agricultural Economics Division of the Agricultural Marketing Service: namely, "research and statistical analysis dealing with income and prices, demand, supply, and consumption of farm products, farm population and rural life, and agricultural history"? What are to be the relationships with the Departments of Agricultural Economics in the land grant colleges

and universities? With work on agricultural prices, income, demand and presumably the Agricultural Outlook assigned to the Agricultural Marketing Service, are these factors no longer to be taken into account in research on farm, land, and range management? What considerations led to the breaking up of the already very small division of Farm Population and Rural Life and assigning part of its activities to the Agricultural Research Service and part to the Agricultural Marketing Service?

Similar questions, no doubt, are in the minds of many economists interested in agriculture and others interested in the economic problems of agriculture. The purpose and intended consequences of the abolition of B.A.E. have not been stated convincingly.

Complete objectivity cannot be achieved by one who spent more than 20 years in the Bureau of Agricultural Economics and one of its predecessor agencies, the Office of Farm Management; who saw farm management change from collecting and summarizing survey records and farm accounts to defining type of farming areas and suggesting changes in farm organization and practice that would increase farm incomes; saw national farm income estimates and the parity price indexes developed; saw comprehensive studies of the economics of soil conservation practices inaugurated; saw the significant contributions the Bureau and its staff made to the "action agencies" of the Department; saw agricultural outlook develop from a very modest beginning designed to give individual producers some guidance as to profitable shifts in production in the year ahead into a comprehensive nationwide internationally-known service accepted and used not only by individuals, cooperative organizations, and private firms in their decision-making concerning agricultural production, processing, and marketing, but also by legislators and official policy makers. But I believe one can say objectively that the urgent and pressing agricultural problems now are primarily *economic* problems, and that this will be true for a considerable period in the future.

This argues for large-scale fact-finding, research, and dissemination of results on the economic front, and organization and administration within the Department and the Colleges comparable in scope to that for the natural and biological sciences pertaining to agriculture. The recommendations of the Black-Schultz-Welch-Cowden-Whetten group given verbally and later in writing to the Department in October, 1953, would if adopted, be a significant step in this direction. But apparently these recommendations have not been accepted.

One must conclude that the present administration of the Department of Agriculture feels that the economic problems of agriculture have been receiving unwarranted prominence in the Department in recent years. Similarly it does not recognize Agricultural Economics as an established

science and profession, even though every agricultural college in the country now has a Department of Agricultural Economics, where both research and teaching are carried on, with a total of nearly 2,000 undergraduate students majoring in the field; and even though the Agricultural Economists have a professional association more than 30 years old, with a membership of several thousand.

USDA REORGANIZATION AND BAE

RAYMOND J. PENN
University of Wisconsin

ECONOMISTS do not question the fact that the changes in BAE were made in a real effort to expand and make more effective social science research, particularly marketing. USDA releases and the Secretary's speeches are clear-cut on this point. Shortly after the new plan took effect the Secretary told the Land Grant College Association that the major areas for expanded service in agriculture are: (1) farm planning, (2) marketing, and (3) public policy—all areas which must draw heavily on social science research.

Is the abolishing of BAE and reshuffling of its functions to the Agricultural Marketing Service and to the Agricultural Research Service an effective way to promote service in these areas? Most agricultural economists doubt it.

The most serious immediate result of the reorganization is its demoralizing effect on the technical staff. They have a legitimate reason for wondering which unit they will be working in, who will be in charge of their research group, and whether someone from an action program or one not primarily interested in research will be transferred into the unit and because of a higher civil service rating become their supervisor. In addition to these questions of a temporary nature, staff members who have devoted their careers to obtaining competence as farm management specialists or land economists wonder how the dropping of those unit names will affect their future. These and many other questions are in the minds of individual staff members. And the insecurity results in considerable loss in research.

These are serious considerations, but for the long run some other results of the reorganization give economists even more concern: (1) Agricultural economics research has been split into two separate administrative units. (2) Marketing research and the collection of basic data and outlook have been put in an administrative unit which also has rather large responsibilities for regulatory and action programs. (3) The name "BAE," which has become one of the best symbols for reliable economic information not

only in the United States but also in other countries of the world, is now abolished.

Splitting agricultural economics research into two independent parts will probably have the most serious consequences. The production economics group in Agricultural Research Service (former division of Farm Management, Agricultural Finance, Land Economics and part of the farm labor work) will be in a better position to work closely with physical scientists, but they also need to be in a position to work very closely with other economists. For instance the Director of the Agricultural Marketing Service is responsible for the Department's outlook work, prices, and statistics as well as marketing. This high level separation of outlook from production economics will certainly not make easier the Department's contribution to individual farm planning. And there is a real danger that the production economics unit could adopt an emphasis which would leave no place for land use, land tenure, agricultural finance, and other resource development problems.

Marketing research at first glance appears to be more fortunate. However, the research done in Agricultural Marketing Service will be but a small part of the work of an organization which has major responsibilities for regulatory and action programs. There will be three research divisions and nine commodity divisions in Agricultural Marketing Service. The research divisions will absorb substantial staff from action programs, many of them with higher civil service rating than persons with similar competence from BAE. Hence there is concern about the possibility that Agricultural Marketing Service policies will not be oriented to research either at the policy making levels or in the technical work units. In addition the Director of another large unit, Agricultural Research Service, has the responsibility for coordinating all research in the Department including that done in Agricultural Marketing Service. R&MA advisory committees which have had so much to do with marketing research are a function of the Director of Agricultural Research Service.

All of these conditions may lead to a situation in which it will be difficult to hold and to recruit top level technicians. Even young economists will be less willing to embark on a career in USDA under these conditions.

Work in agricutural policy, including credit, land, water, forest as well as price policy, will probably suffer most. And yet this is the area which needs our best efforts. Analyses which are realistic for policy decisions require high technical competence both to organize the research on a problem basis and to stand behind the results in the face of political pressure. The chances for improving the research on agricultural policy has not been enhanced by the reorganization. It is not enough to say the Land Grant Colleges should do the research in this area. We need help from USDA.

In the final analysis the effectiveness of the agricultural economics research in USDA and of its contribution to the colleges will depend on the competence of its technicians and the enthusiasm with which they approach their work. I am convinced a better staff could be attracted if all social science research, including Crop and Livestock Estimates work, were in one research and statistical unit. Agricultural economists are virtually unanimous in the hope that the Secretary will find a way to give agricultural economics research in his department the unity and the broad horizons it must have to make the contributions it is capable of making to the problems which face American agriculture.

SOME GUIDING PRINCIPLES IN ORGANIZING AGRICULTURAL ECONOMICS RESEARCH*

THEODORE W. SCHULTZ
University of Chicago

I WRITE this in the belief that past experiences can teach us some lessons about both good and bad ways of organizing agricultural economics. There are others who have had far richer experiences related to this issue than I have had. One thinks at once of H. C. Taylor, John D. Black, W. I. Myers, E. C. Young, Howard Tolley, F. F. Hill, and others. Some critics might say that their interpretations of these experiences are not relevant for they are not organization specialists by virtue of the fact that they are economists. Such critics might argue that organization is the special province of presidents, deans, and of assistant secretaries of agriculture—regardless of what they might have been doing the day before yesterday!

To those who are prone to say to agricultural economists, on this organizational issue, "Stay with your last," we need to make it clear that *Economics* is an organizing science. Economics is fundamentally that, and what is more, it is one of the Big Two, the other being Political Science.

It was not without thought that I called my recent book *The Economic Organization of Agriculture*. Also, in it, I set forth an approach to the problem of organizing research treating the operating research unit as a *firm* which produces a product of value and which in doing so employs a combination of resources and this "research firm" is subject to the same maximization principles, including the matter of scale, as are other firms.

I know there are both good and bad ways of organizing a department of economics, or of agricultural economics, in an endowed university or in a

* Charles M. Hardin and D. Gale Johnson gave me the benefit of their criticism. The responsibility, however, is all mine.

land grant college or university. I can testify on this matter from at least a little experience. One does not get the best teaching and research results by breaking agricultural economics into a number of departments; one for farm management, another for agricultural marketing, another on prices, and still others. The deans and presidents of our land grant institutions have learned that lesson well.

The problem at hand, however, is not agricultural economics at Ames, North Carolina State, Cornell, and Wisconsin—or even at Harvard and Chicago; but it is that of organizing agricultural economic research in the USDA. Let us not embrace the false inference that what is bad for agricultural economics in the land grant colleges is good for agricultural economics in the USDA.

The basic principles that should guide the organization of agricultural economics research in the USDA are clear. But they will be more compelling when seen against the political instability that characterizes the USDA.

Agricultural economics research in the USDA has suffered attrition for over a decade. It has now been split down the middle, farm management forced to go one way and price and income research another. Why have these things happened? Essentially because agricultural economics has been so highly vulnerable to changes in the constellation of political forces—within the Executive, the Congress, the Farm Bureau and other interest groups and within the far-flung "action" agencies of the USDA.

To understand the vulnerability of the BAE, one has to appreciate the profound unfriendliness which these organized political forces, both inside and outside of government, can feel for agricultural economics research that does not provide the "right" answers. We had a taste of this at Ames!

The powerful AAA of the late 'thirties was often unfriendly to agricultural economics research, even to the *Agricultural Outlook*. Where an economic analysis touched them, it usually came under AAA fire. We drew on ourselves this fire power, more than once, in publishing research results in the then *Iowa Farm Economist*. The Soil Conservation Service reacted much the same. At one time it set up its own agricultural economics research unit. At Ames we entered into a cooperative agreement with that unit. But experience soon made it clear that the top administrators did not want careful and critical research. And we had the duty, unpleasant as it was, of publishing without their approval and, also, of letting the cooperative agreement terminate.

A few years ago, the then political forces controlling the USDA wanted land use planning. The BAE was assigned the most vulnerable spot in this new undertaking. To those who were politically in opposition to the forces represented by the USDA, this BAE effort at land use planning was simply a trojan horse to be destroyed, as was soon the case.

Most recently, agricultural marketing has become the big hope politically. In reshuffling the USDA to make the most of this new-found hope, and, incidentally, to divide the formidable PMA and give preference to its marketing activities, the Department's administrative planners decided to dismember the BAE.

As I see the prospects, they are very dim that the USDA can in the near future escape the kind of political instability to which I have been referring. Important shifts in the relevant power constellations from the side of Congress, from within the Executive branches, and from within the far flung USDA—will continue to occur and as they do the instability will be present. What, then, can be done in accommodating ourselves to this political instability in providing for agricultural economic research?

While it cannot be independent of the USDA, it obviously should not be placed in the most vulnerable spot in the Department. The closer it is drawn into the office of the Secretary, the more it will be subject to the political fire and cross-fire around that office. It should not be agent and advocate of any of the major agricultural programs—be it soil conservation, farm price supports, land use, or marketing. To place it on the payroll of any of these, and thus to maximize its vulnerability, either destroys its objectivity or forces those economists who stay to do "harmless," descriptive work.

The Secretary requires much staff work and some of it may be the work of one or more agricultural economists. The various action programs need program analysts some of whom may be economists. But these particular contributions by agricultural economists are a far cry from what is entailed in orderly and "unbiased" agricultural economics research.

The guiding principles are these:

1. Agricultural economics research should be placed in a relatively sheltered position in relation to the political instability inherent in the USDA.

Placing it under the Agricultural Research Services should carry out this principle under the existing overall organization of the USDA.

2. Agricultural economics research should be so organized that it is relatively independent from (1) the day-to-day staff work of the Secretary's office, (2) the constant, routine, "trouble shooting" work, or the quick program analysis work required by the several action agencies.

Placing it in the Agricultural Research Service would also come fairly close to satisfying this principle.

3. Agricultural economics research should represent an effort at long-run analysis where competent workers seek to determine the more basic economic characteristics of agriculture and to explain the behavior of these basic attributes of the economy.

To do this kind of research usually requires years of painstaking effort;

results seldom come quickly; there are many "failures" along the way as hypotheses are tested and are found to be invalid. But this is the essence of research.

4. Agricultural economics research should be organized to take advantage of the strong *complementary* between and among production economics, distribution economics (of which agricultural marketing is a part) and of price and income economics. Some important functions, also indicate complementary, for example, *The Agricultural Outlook* and the publication of *Agricultural Economics Research,* the preparation of *Situation Reports* and others.

Placing production economics under the Agricultural Research Service and price and income economics under the Agricultural Marketing Service *destroys* this very essential complementarity.

5. Agricultural Economics research should be so organized that it has the capacity to recruit and select competent economists and to induce such individuals to join the staff and to make a career as agricultural economists in the USDA.

It is unfortunately true that this capacity has been greatly impaired; nor has all of this impairment come about as a result of the recent reorganization of the USDA.

These five guiding principles are, as I indicated earlier, clear enough. But one finds little in the way agricultural economics research is organized in the USDA that is consistent with these principles.

But from where might some political support for an effective agricultural economics research program come? Efforts by our agricultural colleges in favor of its establishment would be helpful. So, of course, would the recorded support, mild though it might be, of farm organizations—it might even be useful for some of them to declare that they had no opposition to such research. In the final analysis, however, what is really required is an act of statesmanship on the part of the Secretary of Agriculture, perhaps reinforced or even stimulated by the chairmen of the agricultural committees in Congress. Establishment of agricultural economics research in the USDA in accordance with the principles outlined promises little partisan political gain, just as it threatens little loss. Nevertheless, the real public need of such research has been demonstrated repeatedly to everyone who has seriously tried to think rationally about the major problems confronting the agriculture of the United States.

Finally, it might be recalled that the initial land-grants for the Agricultural and Mechanical colleges were provided, not as an easy response to farm demands, but in the face of the "indifference, suspicion, or open contempt" of farmers.[1] And by a Republican administration.

[1] E. D. Ross, *Democracy's College,* p. 96.

PROGRESS CALLS FOR READJUSTMENT*

H. E. ERDMAN
University of California

BEFORE the 1930's our thinking about "The agricultural problem" was largely in a *status quo* atmosphere. When broad changes in the economy had tended to depress prices of farm products, the low prices were commonly ascribed to specific defects in our marketing system or to manipulative practices of "big business." Correction of a fault at one point was assumed to leave the price structure of the rest of the economy unchanged. Departures from normal were to be followed by a return to "normalcy," as the late President Harding once expresed it. We passed laws and established agencies to prevent departures or to bring about corrections. We improved credit to facilitate the purchase of land and encouraged farmers to speed the adoption of new methods and new equipment which would increase production per acre and/or per man. At the same time we bemoaned the drift of farm workers to the city and sought ways to support a price structure which was under pressure from surpluses arising in considerable part from the forward surge in agricultural science and mechanization.

The legislation of the 30's continued the attempt to "normalize" agriculture. The apex of this thinking was doubtless reached with the adoption of the parity yardstick as a guide to readjustment in the production of individual crops and products. Both the Agricultural Adjustment Act of 1933[1] and that of 1938[2] aimed to restore "purchasing power" to the level obtained in 1909-1914 (except for tobacco). In both cases, by implication, the yardstick was to be applied to individual agricultural commodities. The Act of 1933 merely used the term "purchasing power," while the Act of 1938 "spelled out" the definition of "parity." By the late 1940's the *status quo* idea had changed enough to permit inclusion of flexible support schedules in the Agricultural Adjustment Act of 1948.[3] Under this plan support levels would be reduced automatically as farmers' responses showed they were too high.

This paper points out that each new agricultural development has offered promise to the enterprising individual, but that to the less enterprising and to an industry it has often spelled trouble. It tries to show that long-term remedies lie not in regimentation but in alerting the individual to the need for adjustment before he is forced to make it—"as-

* Giannini Foundation Paper No. 134. This paper is a revision of a paper presented at the 1952 meeting of the Western Farm Economic Association.

[1] Public Law No. 10, 73rd Congress.

[2] Public Law No. 430, 75th Congress.

[3] Public Law No. 897, 80th Congress.

sisted laissez faire," if you please. It assumes that various measures will continue to be taken to solve current problems, but urges fuller recognition and utilization in policy making of the tendency of farmers to make major or minor adjustments in their farming operations as the outlook changes.

Changing Ideas

Among outstanding changes which were on the way in the *status quo* atmosphere of the early 1900's were the farm-sized cream separator, the gasoline engine—especially as it applied to automobile and tractor—the two-row corn cultivator, the multiple bottom plow, and improved grain varieties, to mention only a few. The better farming movement was in process of blossoming out into today's elaborate agricultural extension service through which any farmer can get the latest word on modern farming. The persons involved in that movement thought they were doing something which would stem the much deplored cityward movement of young men by making farming more profitable whereas they were actually reducing the need for farmers by speeding up the widespread adoption of new and more efficient processes and equipment.

After about 1910 numerous laws were designed to improve the farmers' status through "better marketing"—to take care of the second ear of corn which worried men like J. A. Everett who said in 1903 in his "The Third Power" (p. 89), that "those who taught farmers to make their farms as productive as possible stopped too soon. They did not show them how to market at a profit." There was regulation of monopolies, of stockyards, of futures trading, of commission men; there were new services—market news, market inspection, development of standard grades; there were laws favoring cooperation and, more recently, laws permitting market control schemes. Seldom was there reference to the fact that financial benefits from improvements tend to disappear rather quickly, so far as the farmer is concerned.

Benefits Become Diffused

Numerous writings deal with the way in which the gains from improvements in agricultural production and marketing become diffused throughout the economy.[4] The gist of the matter is that, on the one hand, the

[4] On the way the effects of improvements spread themselves out through our economy, see: H. E. Erdman. "Who Gets the Benefit of Improvement in Agriculture?" *This Journal*, vol. 11, no. 1, pp. 24-43. January, 1929. Earl O. Heady. "Changes in Income Distribution with Special Reference to Technological Progress." *This Journal*, vol. 26, no. 3, pp. 435-447. August, 1944. Earl O. Heady. "Basic Economic and Welfare Aspects of Farm Technological Advance." *This Journal*, vol. 31, no. 2, pp. 293-316. May, 1949. Sherman E. Johnson. "Agricultural Production After the War." *This Journal*, vol. 27, no. 2, pp. 261-280. May, 1945. Sherman E. Johnson. "A Mid-Century Look at Agriculture in the United States." *This Journal*, vol. 33, no. 4 Part 2, November, 1951, pp. 649-662.

individual farmer behaves as an atomistic firm in the economy, readjusting his individual operations to new opportunities for profit, but that, on the other hand, the sum of individual actions is increased supplies and lowered prices for the industry. Progressive farmers make money because they take up the new before its general adoption has lowered prices. They continue to prosper so long as they stay ahead of the crowd. The final respository of such benefits of progress tends to be primarily the general public as consumers.

Diffusion of benefits also follows improvements grouped as "better marketing." Here, however, the benefits are usually so intangible that most persons, if they gave the matter a thought, would consider this discussion sheer nonsense. The changes which follow from a particular innovation, whether in production or marketing, are nearly always obscured by other changes which occur within the same period. For example, suppose one desires to measure the price effects of the A.A.A.[5] or of the use of hybrid seed corn. Schultz and Brownlee undertook in 1942 to evaluate the activities of the A.A.A. in reference to feed production.[6] They estimated that, for four Corn Belt states during the decade of the thirties, corn acreage was down about 10 percent, but yields were up 34.6 percent, so that total production was up about 20 percent. Three main factors were at work simultaneously: (1) The A.A.A. was seeking to get some corn acreage replaced by soil-building forage crops. The results were (a) the removal from corn production of some of the poorer land, thus increasing the average yield for the area, and (b) increasing the productivity of corn land by better crop rotations. (2) Producers were rapidly shifting to the use of hybrid seed corn. In Iowa alone the use of hybrid seed corn increased from 0.4 percent of planted acreage in 1933 to 88 percent in 1940.[7] (3) The weather was unusually favorable during much of the period. The researchers could only approximate the effect of the A.A.A. They estimated that each factor was responsible for about a third of the increased corn yield.

We need also to ask ourselves where the completion of the diffusion process leaves the interested parties. With such an improvement as hybrid corn, the consumer will continue to benefit as prices fall, but some farmers will find the prices so unattractive that sooner or later they give up corn growing for some other crop, or some other vocation. On the other hand, a marketing agreement under which prices and returns are raised by diverting part of a crop to secondary uses may lead farmers to increase

[5] Agricultural Adjustment Administration.

[6] T. W., Schultz, O. H. Brownlee. *Effects of Crop Acreage Control Features of AAA on Feed Production in 11 Midwest States.* Iowa Agricultural Experiment Station Research Bulletin 298, 1942, pp. 675-696.

[7] *Ibid.* p. 682.

production, thus necessitating higher surplus disposal rates. Under such circumstances, consumers would pay higher prices either or both because of the monopolistic device itself or because of the diversion of resources from their best use. And if, as might well happen, the agreement were discontinued because of increasing frictions in its administration, producers would be in a worsened position while consumers might gain temporarily.

Facilitated Adjustment Approach

If the long-term effects of improvements tend inevitably to be diffused throughout the economy, must we adopt a do-nothing policy? I think not. But we do need to face the fact frankly that improvements in agriculture, except those needed to keep up with population growth or depleted soils, will worsen the position of some farmers; that in a progressive economy there are always some farmers who should be readjusting, some even to the extent of leaving the farm. In the past some of these have readjusted too slowly, or have over-stayed their time on the farm. Relatively, the shift out of agriculture should slow down now that only about 15 percent of the gainfully employed are in agriculture. What we need is a policy of facilitating voluntary individual adjustment to changed conditions. The writer has suggested on numerous occasions that some farmers be encouraged to leave the farm if, as he believed was the case, fewer and fewer farmers could feed the growing national population as mechanization and scientific methods become more common. When the suggestion was made at a farmers' meeting in the spring of 1925, the extension director waived the suggestion aside by saying that farmers adopt new methods too slowly to affect prices by their actions. When a similar but more specific suggestion was made at a farmers' meeting in the fall of 1927, the governer, in his banquet speech that evening, said he hoped the remark was facetious and proceeded to laud farming as a way of life.[8] These attitudes led the writer to spell out his ideas more fully in a paper on "Who Gets the Benefit of Improvements in Agriculture?"[9] in 1929, and again in 1949 in a chapter on "Government Control of Agricultural Prices."[10]

The point in mind is essentially the need for a reorientation in our thinking about long-time goals and how to attain them in a free economy. We need to bear in mind that individuals tend to adjust their operations to each new development; that each adjusts to the advantage point as

[8] Monthly Bulletin, California State Department of Agriculture, vol. 17, no. 2, February, 1928, pp. 127-128.

[9] *This Journal*, vol. 11, no. 1, January 1929. pp. 24-43.

[10] Published under the title of "Government Control of Agricultural Prices" as Chapter IV of *Twentieth Century Economic Thought*, edited by Glen E. Hoover, and published by Philosophical Library, New York, 1950.

he sees it, which is seldom as the industry composite sees it; that, when an industry scheme is set up which restricts the constituent individuals, combined pressure from the latter will sooner or later find a way to break through any constraints.[11]

The United States Congress has long been solicitous of the welfare of farmers. Witness the long list of Acts from the Homestead Act of 1862 to the Agricultural Act of 1952. Under this legislation, our program for agriculture has included four main categories for action:

1. Actions designed to promote efficiency in farming and marketing enterprises.
2. Actions designed to soften the impact of such disasters as flood, drought, and more recently, price changes.
3. Actions aimed directly at raising the level of farm living.
4. Actions designed to implement gradual readjustment.

The first group was largely designed to implement the old desire to "make two blades of grass grow where one grew before."[12] More recently, we have added improved marketing as an answer to the farmers' question about disposition of the second blade of grass. Most of the real advantage has ultimately gone to consumers while a very considerable group of farmers has had little, if any, advantage as producers.

In the second group we have ordinarily done little of a systematic sort to mitigate the results of disaster. A significant development along this line in recent years is crop insurance.[13] In the last two decades, we have added a group of industry control and/or adjustment schemes designed to mitigate the results of abrupt economic change or soften the effect of competition. Many of these have doubtless served a useful purpose in the short run. Marketing agreements and orders have lessened the shock of low prices brought on by seasonal surpluses of perishables, the Commodity Credit Corporation has stepped in when supplies of storable products became burdensome, and quota schemes have helped in some cases. These devices doubtless have a long-run usefulness if used judiciously in solving short-run problems.[14] The added stability of prices

[11] See G. L. Mehren, *Agricultural Market Control Under Federal Statutes*, University of California, Giannini Foundation of Agricultural Economics Mimeographed Report No. 90, 1947, pp. 29-30.

[12] The oldest American reference to come to my attention on this point is that credited to Thomas Jefferson who had probably read Jonathan Swift's *Gulliver's Travels* (published in 1721) in which the King of Brobdingnag lauds the man who "could make two ears of corn or two blades of grass to grow . . . where only one grew before. . . ." On Jefferson, see Hugh H. Bennet, *Thomas Jefferson, Soil Conservationist.* U. S. Soil Conservation Service Misc. Pub. No. 548, 1944, p. 3.

[13] Harold G. Halcrow, "Actuarial Structures for Crop Insurance." *This Journal*, vol. 31, no. 3, August, 1949, pp. 418-443.

[14] See G. L. Mehren, "Some Economic Aspects of Agricultural Control." *This Journal*, vol. 30, no. 1, February, 1948, pp. 29-42.

should make farming safer, but by the same token should keep some men on the farm who would otherwise leave, with the end result of lower, though more stable, prices.

The third group, that aimed at improving the level of farm living, has included mainly such items as good roads, better rural schools, and rural electrification. Here land values may tend to absorb some of the gain, but rural consumers will keep a "living content" advantage, and all consumers will tend to gain by whatever extent such improvements keep a larger farming population "on the job," and hence exercising a downward pull on prices of farm products. Thus, although farm life may be more pleasant because the workday is shorter, the work less arduous, and the home more comfortable, these very advantages may keep enough men on the farm (who would otherwise have left) to pull price levels downward.

These three lines of action should be continued since, in the first instance, they help the progressive element in the farming population and, in the second instance, contribute to the long-run well-being of the general public. But we should emphasize particularly the fourth point, namely, expediting gradual adjustment.

Action to Implement Gradual Readjustment

There is abundant evidence that the American economy is decidedly fluid; that enough persons stand ready to make advantageous changes to keep the economy in relative equilibrium provided enough know the basic facts. Note that about 95 per cent of Iowa farmers adopted hybrid corn in about ten years;[15] that wheat growers in some north central states largely switched from Marquis wheat to the Thatcher variety in about five years because the new variety was less subject to stem rust;[16] that between 1930 and 1949 turkey production rose from 17 million birds to some 41 million;[17] that sheepmen decreased flocks from 56 million sheep and lambs in 1942 to 31 million in 1950;[18] and that between 1930 and 1950 harvested soybean acreage increased from about one million acres to 13 million, over 80 per cent of which was in six cornbelt states.[19] Expansion of soybean acreage involved a farm organization problem, for here is a cultivated crop which in part displaced oats. The reorganization of the farm is more difficult than changing varieties or practices, yet dur-

---

[15] Schultz and Brownlee, *op. cit.*, p. 682.

[16] J. A. Clarke, and K. S. Quisenberry. *Distribution of the Varieties and Classes of Wheat in the United States in 1939.* U. S. Department of Agriculture Circular 634, 1942, pp. 42-44.

[17] U. S. Department of Agriculture. *Agricultural Statistics, 1950.* p. 480.

[18] *Ibid.*, p. 382.

[19] Ohio, Indiana, Illinois, Iowa, Minnesota, Missouri. Figures compiled from USDA Yearbook 1931 p. 799 and Agricultural Statistics, 1952 p. 160.

ing the decade of 1940-50 farmers in the well established east-north central farming area (Ohio, Indiana, Illinois, Michigan, and Wisconsin) increased the size of farms 12 per cent by decreasing their number at about the same rate.[20] On a broader basis, the whole economy is fluid as indicated by the fact that, whereas in 1910 some 31 per cent of our gainfully employed were in agriculture, the figure had declined to 17.6 per cent by 1940[21] and probably now stands at about 15 per cent. Such a shift was made possible and desirable by the fact that American farmers adopted the new at a rate which doubled output per agricultural worker between 1910 and 1946.[22]

These adjustments were the results of thousands of individual decisions. Many of these were doubtless expedited by knowledge provided by our agricultural extension service. What is needed is not only information on the basis of which those decisions may be made with a high degree of correctness but on the basis of which some farmers might retreat from farming before low returns wreck them. With increased speed in the adoption of new processes or equipment, the tempo of readjustment needs also to be increased.

Among the devices or methods of expediting adjustment, the following deserve special attention:

a. The crop and livestock outlook service of the USDA and the state agricultural colleges were steps in the right direction and should receive added emphasis.
b. Farmers and their families need information on wages and employment opportunties in other parts of the country in various lines of economic activity. The automobile has already done much to increase the fluidity of the younger element in the labor supply. The United States and state employment services should be strengthened and expanded.
c. A special service is needed by boys of school age. If in some sections more young folks are growing up on farms than will be needed, some may well choose occupations other than farming. But such occupational guidance needs the best counseling that can be obtained. Glorification of farming as an occupation is not a solution.
d. Education for readjustment is needed. If it is farmers who need to learn the growing of new crops, the use of new methods, or ways of reorganizing the farm, the job is one for the agricultural extension service and the agricultural schools. The more general adoption of

[20] Computed from Agricultural Statistics, 1950, p. 621.
[21] U. S. Department of Commerce. *Historical Statistics of the United States, 1789-1945*, Washington, Govt. Print. Off., 1949. p. 63.
[22] M. R. Cooper, *et al. Progress of Farm Mechanization.* (USFA Misc. Pub. No. 630) Washington, Govt. Print. Off., 1947. p. 7. The index of production per worker rose from 154 in 1910 (1870 = 100) to 324 in 1946, an increase of 110 per cent.

the budget approach to farm planning would do much to expedite adjustments.[23] If it is education for another vocation than farming, there are already many night schools and adult training schools. Here again, guidance is needed. There is no use in training a boy or retraining a man for a job he cannot handle when he has been trained, or for one which is closed to him because of union rules or other restrictions.

e. The various credit agencies need to be alerted to the nature of the adjustment process and to the part they can play. It is often folly to extend credit to persons who may find themselves in virtual bondage if they expect to pay out on a narrow margin "in the long run" of forty years—five or ten years is a long time for a family of youngsters to live in such a situation.

f. We need to develop further the use of various indexes which indicate where changes are going on in such a way as to be helpful to farmers. The old "purchasing power" index and the "parity" index were useful in a broad sense to show directions of change. Indexes would be useful which show regional changes in such aspects as land prices, rentals, foreclosures, tax deliquency, etc. Professor Black has recently suggested the use of indexes patterned after the Boston milk index developed a few years ago.[24] A variety of special indexes —such as the egg-feed price ratio, the hog-corn price ratio, etc.—is already being published by the U. S. Department of Agriculture.

g. We need to examine proposed control schemes to make sure they to not merely postpone an evil day, or even make that day a gloomier one than it would have been without the control.

Conclusion

The type of program here suggested is positive and forward looking; it assumes a continuation of the free enterprise and personal initiative that has long characterized American agriculture; it tells no one what to produce but helps the inquiring individual to select wisely from among the available ways of helping himself to readjust his farming operations; it includes means of softening some of the harsh effects of competition; it recognizes the fact that our developing economy contains a variable fringe of persons who should be making fairly severe occupational adjustments but that only moderate adjustments are called for by most American farmers. Its emphasis on facilitated individual decision provides the basis for a continuation of "the American way of life."

---

[23] The comtemplated approach is that used by J. D. Black, et. al., in *Farm Management*. The Macmillan Company, New York, 1947.

[24] John D. Black, "Coming Readjustments in Agriculture—Domestic Phases." *This Journal*, vol. 31, no. 1, part 1, p. 12.

ON LETTING GO OF THE BEAR'S TAIL

GEORGE K. BRINEGAR AND STEWART JOHNSON*
University of Connecticut

LARGE numbers of farmers in the United States now have a bear by the tail. The bear, being such techniques as production quotas, tariffs, export subsidies, and multiple-price plans, which cause farmers to be paid more for additional output than the additional output will sell for, drags the farmer up the mountain of initially increasing profits, followed by increasing production and costs, which in turn leads to decreasing net returns. This bear has led many farmers to high and giddy altitudes where they are working too hard and at the wrong places, using too many resources and in the wrong combination, to produce more agricultural commodities than consumers are willing to buy.

Choice to take the trip with the bear, or is the trip a ride on the back of a tiger, was made by farmers through the political process. Moreover, we can assume that if a change in traveling companions is made the choice will again be made by farmers through the political process. Thus, the problem becomes how to let go of the bear's tail following a disengagement operation that is acceptable to farmers.

The proposed disengagment operation, in its essentials, consists of (1) capitalizing the above-free-market premiums farmers now receive, (2) establishing free markets in which these rights can be exchanged, and (3) eventual elimination through government purchase of these capitalized premiums. Thus, in the long run the program would be largely price stabilizing rather than raising.

The Objective

The proposal suggested is designed to bring about approximately the same total output, by the same persons, in the same locations, using the same resources as if uncontrolled markets were in operation. The proposal is not designed to immediately bring about the same distribution of income or use of commodities as would be found in the presence of an uncontrolled market. The proposal is not intended to lead to Utopia but only to bring a significant improvement from the status quo. Moreover, careful study of specific situations is needed in order to evaluate the gains obtainable through adoption of the proposal as compared with the administrative cost.

---

* The writers wish to acknowledge the useful criticisms received from Arthur Dewey, Irving F. Fellows, Harold G. Halcrow and George G. Judge of the University of Connecticut.

We assume that farmers will be delighted to let go of the bear's tail if this may be done in such a way that no farmer is as a consequence made worse off. Likewise, we assume consumers will favor the adoption of such a scheme if they are made better off. Thus, the key problem is to present a pricing system, satisfactory to farmers, that will reduce the prices farmers receive for additional output to a point neither above nor below what an addition unit of the commodity would sell for in an uncontrolled market. Attainment of this objective is indispensable if the price system is to be used in bringing about the production of commodities in the ratios which would exist if economic efficiency were to be maximized. Before presenting a proposal for letting go of the bear's tail, a detailed examination of the bear and the mountain he has climbed is in order.

Where We Are

Examination of what appeared to be a bear and a mountain turns out to be several bears and several mountains. Thus, a detailed examination is made of how farmers were dragged to where they are with reference to several commodities. However, in spite of the great differences in where farmers are with reference to specific commodities a common denominator is present. This common denominator is that farmers receive more for the production of an additional unit of output than this output is worth. This common denominator is emphasized so that it will not be lost sight of when the more detailed picture is presented for several individual commodities.

Sugar

The American sugar producer is paid more for his sugar than it can be sold for in an uncontrolled market. Moreover, he is paid more for the production of an additional hundred pounds of sugar than the amount for which this additional sugar can be sold. Additionally, new producers are in effect told that if they enter the business they too will receive more for their sugar than it is worth.

How is the money obtained which is used to pay sugar producers more than free market prices? This money comes from several sources and is collected with the use of several techniques. A tariff of approximately one-half cent a pound is in effect on imported sugar. Secondly, import quotas are used to further restrict the supply of sugar available for consumption in the domestic market. Thirdly, a processing tax of one-half cent a pound is levied on all sugar refined in the United States. The funds so obtained are used to make direct payments to domestic sugar producers, amounting to $61,000,000 on the 1952 crop. In 1952 these pay-

ments increased the amount producers received from the sale of beets by 20% while the corresponding figure for sugar cane was 17%.

In addition to the several techniques which have been described to increase the output of domestic sugar, measures to restrict its production have been announced for 1954, for the first time since before World War II. Acreage allotments limiting sugar cane production have been prescribed for Florida, Louisiana and Puerto Rico.

Interestingly enough, note should be taken that the non-Aristotelian logic of the bear has led the domestic cane sugar producer into the position of being simultaneously directed to produce more and less (more by price-raising techniques such as tariffs, and less by quotas applicable to individual farms).

Fluid Milk

In most fluid milk markets in the United States, the producer is paid more for the production of an additional hundred pounds of milk than this milk is worth on the market. Additionally, new producers are in effect told that if they enter a fluid market they will be paid more for their milk than the amount for which their milk can be sold.

Where does the money come from which is used to pay for additional supplies of milk at a price which is more than that at which the milk is sold? This money is obtained by decreasing the average price for all milk sold by all producers. The mechanics of taking money away from one producer and giving it to another are quite simple. As more milk is delivered to a market, the amount of surplus is increased, and the blend or average price received by all producers for all milk goes down.

The magnitude of the discrepancy between what farmers are paid for additional milk and what the additional milk is sold for is significantly affected by the pricing system used in the market. In many fluid milk markets the Class I price is reduced as the percentage of total milk supply used in Class I decreases. Such reductions are brought about automatically by "supply-demand adjustment factors" included in pricing formulas in most federal order markets. In other markets, increasing surpluses are a bearish bargaining factor in price negotiations.

In a few markets, on the other hand, the Class I price is adjusted upward when supplies increase relative to Class I sales, in an effort to maintain blend prices to producers. An example is the Rochester, New York market. Between 1948 and 1952, surpluses increased in both the New York and Rochester markets, and proportionately more in Rochester. Yet between August 1948 and August 1953, the Class I price was increased 20 cents per hundredweight in the Rochester market (from $5.80 to $6.00, f.o.b. the market, 3.5% butterfat) while it was reduced by 68 cents per

hundredweight in the New York market (from $5.90 to $5.22, 200-mile zone, 3.5% butterfat).

The percentage use in Class I and II-A (fluid milk and cream) has steadily declined in the Rochester market in each of the seven years since 1946. The gains to producers in the blend price resulting from raising the Class I price have been largely dissipated by increasing production. This has occurred despite the inability of new producers to enter the market, under state regulations prohibiting health approval of new farms if "the market is already adequately served." Consumers in the Rochester market have paid and are paying a higher-than-necessary price for milk, distributors' volumes have been curtailed below those which would otherwise have existed, yet producer gains in a higher blend price have all but disappeared.

In Rochester, where the right to sell milk goes with the farm, a new entrant must buy out an existing producer to have a market. This holds true in other markets, for Connecticut farmers wishing to sell milk in the Rhode Island market, as an example. In past experience, quotas or market rights usually have been transferred among farmers by this and other awkward means, such as truckers transferring milk from cans of one farmer to another at some point between the producers' farms and the dealers' plants. Quotas and restricted entry do not apply at present in many markets, but rights to transfer quotas, where used, usually have been severely restricted. An exception was the Chicago market in the early 1930's, where quotas are reported to have been bought and sold for as high as $1100 per 100 pounds.[1] The use of "non-transferable" quotas causes the cost of producing milk to be higher than it otherwise would be by encouraging the "wrong" people to use the "wrong" level and combination of inputs to produce milk in the "wrong" places.

Wool

The wool producer is in a position that is in many ways similar to that of sugar producers. The world market price of apparel wool is below that of domestic wool in the United States.

The money to pay producers more for additional output of wool than what it is worth comes from (a) users in the United States who pay more than a market-clearing price for their wool supplies;[2] and (b) the United States government, from losses on price-support operations. Since imports of wool amounted to as much as 69 percent of total United States

---

[1] *Base Allotment or Quota Plans used by Farmers' Cooperative Milk Associations,* Wm. C. Welden and Louis F. Herrmann, Farm Credit Administration, Cooperative Research and Service Division, Miscellaneous Report No. 23, May 1940.

[2] The discussion applies to apparel wool only, not to carpet wool.

supply in 1950, 65 percent in 1951, and 62 percent in 1952, the cost to the United States consumer has been great.

The devices used to obtain higher-than-market-clearing prices for wool are tariffs on imports and support-price purchases of domestic wool.

The tariff is 25½ cents per pound, clean content, which is about 20 percent of the duty-free price of imported wool.

Under the support-price program, purchases and non-recourse loans are made at 90 percent of parity. On July 1, 1953, U.S. stocks of wool under the support program amounted to 101,000,000 pounds, a volume representing 38 percent of domestic production in 1952.

Wheat

The wheat grower is also well up the mountain in that additional output of wheat in the United States is sold for more than it would bring in an uncontrolled market. Existing producers who wish to expand as well as prospective new producers are told that if they produce extra wheat, the price paid them per bushel will be more than the wheat is worth.[3]

The money for this payment at higher-than-market-clearing prices comes from domestic users, through paying a relatively high price for wheat as bolstered by the government support program, and from taxpayers who finance the support program.

The techniques used which assure United States producers more for additional output of wheat than what it is worth are purchases and non-recourse loans under the support price program, quotas restricting production on individual farms, export subsidies, tariffs, import quotas, and multiple-price plans for disposing of government stocks.

The price-support level for wheat, a "basic" commodity, is fixed at 90 percent of parity. That this price is far above market-clearing levels is indicated by the huge government holdings of wheat (788 million bushels on October 15, 1953).

Quotas on wheat marketings by individual producers were used in two prewar years, 1941 and 1942, though allotments have been used in several other years. They will be used again in 1954, cutting acreage to 62,000,000 acres compared with 78,000,000 in 1953. Quotas were favored by 87.2 percent of the wheat farmers voting in a referendum on August 14, 1953, the alternative to a favorable vote being both the absence of quotas and a materially lower price-support level. Quotas in 1954 are non-transferable except as farms to which quotas are attached are bought and sold.

Export subsidies are paid on sales of wheat to foreign countries. They amounted to $167,000,000 in the year ended July 31, 1952, averaging 65½

[3] When acreage allotments are in effect inputs other than land must be used to increase output.

cents per bushel on 255 million bushels. In the year ended July 31, 1953, the export subsidy cost $142,000,000, averaging 55 cents per bushel on 258 million bushels. These costs do not include gifts of wheat to countries suffering from famine, or loans to countries for purchases of wheat.

A tariff of 21 cents per bushel applies to imports of wheat for consumption. Imports also are restricted by quotas under which only 800,000 bushels may be brought into the United States for consumption in any calendar year.

The most important multiple-price plan for disposing of government wheat domestically was the feed-wheat subsidy program effective from January 19, 1942 through June 30, 1945. Under this program, 782 million bushels, equivalent to about three-quarters of a year's production, was subsidized for feed to livestock.

Cotton

Cotton growers, like many other farmers, receive more for the production of an additional bale of cotton than this cotton is worth on the market. Also, new producers are told that if they begin production, they will be paid more for their cotton than it can be sold for.

The money used to pay more for additional supplies of cotton than they can be sold for comes from domestic consumers who buy their cotton at the price-support level and from taxpayers who finance the government's price-support operations.

Techniques used to force domestic consumers to pay more for additional cotton than what it is worth are support-price loans, production quotas, import quotas, tariffs, export subsidies, and multiple-price disposal programs. They are used in an industry for which domestic uses took 67 percent of total production in the 5 years ended July 31, 1953, and exports 33 percent. Imports, mostly of special grades of cotton, accounted for one percent of domestic consumption in the year ended July 31, 1953.

New areas of production becoming increasingly important in recent years are California, Arizona, and New Mexico. Quotas based on historical acreages have retarded but not prevented substantial shifts in areas of production, partly because they have been used in only seven of the past fifteen years.

Cotton is one of the "basic" commodities, and price supports are fixed at 90 percent of parity. Non-recourse loans are used as the method of support.

Quotas were set for individual farms in seven of the years beginning with 1938. They were last used in 1950. They will again be used in 1954. Quotas are based on average acreages planted on the farm in the preceding five years. They are non-transferable, staying with the farm operator or a purchaser of the farm.

The tariff on imported cotton is 3.5 cents a pound on medium-staple, and 1.75 cents a pound on long-staple, with no tariff on short-staple. In addition to tariffs, there are quotas which restrict the volume of imports of medium-staple and short-staple cotton.

Export subsidies do not apply currently. They were in effect between December 1944 and December 1950, beginning at four cents per pound (19 percent of the price paid farmers for the 1944 crop).

To reduce cotton supplies, various multiple-price plans have been used in the domestic market since 1932. From 1932 through 1944, the cost was $138 million. About half of the total cotton used went for a "Mattress and Comforter Program" under which mattressess and comforters were made by relief agencies and delivered to low-income families, or the material was given to low-income families for such use. No such programs are now active.

Tobacco

The tobacco producer is in a position similar to that of many other farmers in that he frequently receives more for his produce than it is worth on the free market.[4]

The techniques used to increase the prices that tobacco producers receive have been many. Tobacco farmers have attempted to form private monopolies and thus set prices. Other devices such as import quotas, tariffs, marketing agreements, acreage allotments, and free tax warrants have been used in the effort to increase returns to tobacco growers.

The right to grow tobacco has become a valuable asset. Mason, for example, presents the following quotation:

> *"How much is a tobacco allotment worth?"*
> *"Well sir. I reckon it's worth right much nowadays. Th' sayin' goes around here that a tobacco farm sells for a thousand dollars for every acre of allotment. They'll tell you that all over North Carolina."*[5]

The specific examples he cites are indicative of the waste which is involved when a free market for the purchase and sale of allotments is not permitted.

The Proposal

The proposed method of letting go of the bear's tail has three essential characteristics. These are:

---

[4] The amount involved has varied from time to time and among types of tobacco. A detailed study of the burley control program, for example, is presented by Glenn L. Johnson, *Burley Tobacco Control Programs*, Kentucky Agricultural Experiment Station Bulletin 580, 1952.

[5] John E. Mason, *Acreage Allotments and Land Prices*, Journal of Land and Public Utility Economics, Vol. XXII, p. 176, 1946.

(1) Convert the premiums that farmers receive from the use of production and marketing quotas, tariffs, export subsidies, multiple pricing schemes, etc., to property rights which can be capitalized.
(2) Establish markets in which these property rights (quotas based on output) can be bought and sold at little or no direct cost to the buyers and sellers.
(3) Provision for automatic elimination of premiums through purchases, reissues, and corresponding devaluations of quotas.

Conversion of the premiums which are now received by farmers in the form of higher-than-market-clearing prices could be accomplished in several ways. One of the least complicated would consist of minimum price guarantees for specified amounts of commodities, and the assignment of these specified amounts to individual farmers through quotas. The issuance of output quotas would restrict the amount of product for which the producer could receive a premium. The balance of the output would be sold in an uncontrolled market. Marginal revenue to the producer for a change in output, therefore, would be the same as in an uncontrolled market. An increase in the efficiency with which resources are used would come about because the gain or loss the farmer would realize from changing his output would be equal to the price times quantity at which the commodity would clear the market, rather than at some higher price.

Establishment of a market in which quotas could be bought and sold would lead to a more efficient use of resources than would exist if sales of quotas were frowned upon as illegal, and transfers took place sub rosa. The increase in efficiency would result from the fact that quotas would not be tied to individual producers or become capitalized into land or farms, and would thus put no restriction on where or by whom the commodity was produced.

The automatic elimination of premiums would be implemented by (a) government purchase of quotas, (b) reissue of quota purchased to owners of quota, and (c) reduction of premium guaranteed by quota equal to the amount of premium that would have been paid on quota purchased and redistributed. In no case would the premium be reduced so that the price the farmer is entitled to would fall below the uncontrolled market price of the commodity in the preceding year. Thus, after this provision has been in operation a number of years the chief effect of the program would be that of price stabilization at approximately the equilibrium level rather than that of price raising.

Some of the detailed features of this type of program are presented for six commodities, as illustrations, in the following sections of this article.

Sugar

A closed quota system, under which the only opportunity to obtain new quotas is by purchase from original holders, is contemplated with sugar.

Quotas would be assigned to individual producers according to some historical-base procedure, and, after their first assignment, the opportunity to earn new quotas simply by producing at non-quota prices would be denied.

The sugar quotas which are issued would entitle producers to receive as much for their sugar in the future as they now receive. The calculation of "as much" could be in terms of cents per pound or in terms of purchasing power per pound. The quotas would be in terms of volumes of refined sugar for which reliable daily quotations are available throughout the year, with appropriate conversion factors for the individual producers of sugar cane or beets.

Non-quota sugar would be sold for the U.S. market price. Tariffs and import quotas would be eliminated, as well as the present system of program payments. The "as much" price guarantee for quota sugar would, of course, take into account the present program payments.

The government would be "starting from scratch" in the establishment of a market for sugar quotas. There could be a central market in Washington, with branches in the important sugar producing areas. Quota certificates could be registered much like stock certificates, and transferable among neighbors, under the proper legal procedure, as well as on the central market.

When beets or sugar cane are delivered from farms, the buyer would pay the uncontrolled market price. If accompanied by a quota, a certification cashable by the quota holder would be made out by the buyer. The holder of the quota could cash this certification on any business day, the amount he receives depending on the difference between the guaranteed price and market price of sugar on the day he settles with the governmental agency handling the sugar program.

As with other commodities, it is suggested that the government each year buy at least five percent of the quotas outstanding. The purchase price would be whatever quotas were selling for in the market, subject to certain ceilings. If estimated production fell below that in the base year, additional purchases so that outstanding quotas did not exceed domestic production would be made.

At the end of each year, the purchased quotas would be redistributed pro rata to those owning them. At the same time, the guaranteed support price would be reduced by the amount necessary so that annual government payments on the new quotas, plus the payment which would have been made at the old rate on the quotas purchased, would remain the same as if no purchases had been made and the old rate had remained in effect.

Payments for purchase of quotas would be from a special governmental account for the sugar program. Payments would be made in full on the day of the transaction.

Fluid Milk

Unlike sugar, for which a national market exists in the United States, pricing of fluid milk varies among different milksheds. The discussion below concerns such markets, rather than the national market for butter, cheese, and other manufactured dairy products.

A "closed base" system, under which the opportunity to obtain new bases other than by purchase from original holders is extremely limited, is necessary for the accomplishment of the objectives previously outlined. This means the assignment of quotas to individual farmers based on their production of milk in specified time periods, and denial of the opportunity to make new bases in subsequent years.

Non-quota milk could be paid for at the lowest class price prevailing in the market. For quota milk, a "blend" price, after accounting for non-quota milk at lower prices, would be paid. If quotas in the Rochester, New York market had been determined by deliveries in October-December 1952, for example, the non-quota price in July 1953 would have been $2.74 per hundredweight, and the price for quota deliveries at least $4.87 per hundredweight, as contrasted to a flat blend of $4.49 which actually prevailed.

In markets regulated by the state or federal government, machinery for auditing dealer usage, calculating blend prices, and enforcing minimum prices to producers already is in operation. Having an auxiliary division to provide a market where quotas could be bought and sold would be relatively simple.

To help establish a ready and active market for quotas, it is suggested that in each year the Market Administrator buy five percent of the quotas initially outstanding. Whatever market prices prevailed would be paid for the quotas, possibly within certain ceiling price limits, with 1/12 of the year's purchases being made each month.

Quotas purchased would be re-distributed pro rata to holders thereof at the end of each year. At this time, the Class I price could be reduced by an amount which would reduce pool income by the same dollar total as the premium payments on quota over non-quota milk on the amount of quotas purchased. This does not prelude, of course, other changes in class prices which would be occurring from time to time depending on the situation in the market.

Payments for quotas would be made from the equalization fund if a market-wide pool arrangement was followed. Under a handler pool, in which use of the plan is less likely, pro rata deductions from handlers' accounts could be used. It is suggested that payments for purchase or sale of quotas be made by 24 monthly installments, the payment contingent on continued use of the quota plan in the market.

Quotas would be usable each month only as registered with producers

making deliveries of milk. If held by non-producers, or if producers did not deliver as much milk as the quotas held by them, the effect would be to increase the price of quota milk because of its smaller volume.

Tobacco

Unlike sugar and fluid milk, exports are important with tobacco, net exports amounting to 18 percent of domestic production in 1952. Changes in the quota system which are contemplated with tobacco, therefore, have important implications with reference to our export trade.

Although there are many types of tobacco, two of these, flue-cured and burley, accounted for 92 percent of the total farm value of tobacco in the United States in 1952. Flue-cured, the most important type and for which exports amounted to 33 percent of domestic production in 1952, is used in illustrating the plan for tobacco.

The essentials of the proposal for flue-cured tobacco are the same as for sugar and fluid milk. Specifically, the steps suggested are the stating of quotas in terms of output, making quotas transferable, establishing central markets for the buying and selling of quotas, having the government enter into the trading on the buying side (to a limited extent), and gradually reducing price-support levels as quotas are purchased.

The quotas would be assigned to individual producers of flue-cured tobacco according to some historical-base procedure, probably the one now followed. All producers, including those with fractional acreages, would be eligible to apply for a quota, which would be stated in terms of output. After the initial assignments, no new quotas could be earned.

The quotas on flue-cured tobacco would entitle producers to receive as much for their output in the future as they now receive, probably in terms of purchasing power rather than an absolute figure. A central market for the purchase and sale of quotas would be established, and transfers legalized on this exchange as well as among individuals off the exchange. The establishment of a central market will increase the perfection of the market, and thus will tend to prevent some farmers from selling their quotas to neighbors at one-quarter or one-half the price in other localities. The central market for quotas thus serves the same purpose as central markets for other goods.

When tobacco is delivered from producers with quotas, the buyer would pay the uncontrolled market price and make out a certification cashable by the quota holder. The holder of the quota could cash this certification at his discretion on or after the day of sale of his tobacco, receiving the difference between the guaranteed price and the free-market price on the day he settles with the governmental agency handling the tobacco program. This procedure would be dependent, of course, on the

development of a market from which reliable daily quotations for flue-cured tobacco could be obtained. An alternative with some advantages would be to use the free-market average price for the year rather than the quotations for specific days.

Non-quota flue-cured tobacco likewise would be sold for the U. S. market price, but since not accompanied by quotas no certification cashable by the seller would be issued. Producers of all sizes, both those with fractional acreages and those with large-scale production, could either retain quotas earned by prior production or obtain quotas by purchase, and thus receive certifications for all sales, or could sell any quotas they might have and receive only the market price on their sales of tobacco.

The U. S. market price of flue-cured tobacco would be determined by the supply and demand situation, both domestically and internationally. It is contemplated that U. S. tariffs and quotas on all tobacco would be eliminated under the proposal, and that no governmental-subsidized export program would be followed by the United States.

The market price would be expected to fall below the support-price level if the suggested proposal were adopted, and the volume of exports consequently to increase moderately. Precise estimates of initial and subsequent free-market prices and volumes of production, imports, and exports are beyond the scope of this article.

As with sugar, it is contemplated that the government buy at least five percent of outstanding quotas on flue-cured tobacco each year. At the end of the year, purchased quotas would be distributed pro rata to private holders thereof, and the guaranteed support price reduced by the amount payments were decreased due to quota purchases.

Wool

The program for transferable quotas, and an active market for purchase and sale of quotas, would be similar to that for sugar. Quotas would be allocated to individual producers according to output of wool, in the same manner as sugar quotas would be allocated on the basis of sugar yields from cane and beets. With substantial imports, the freeing of foreign trade would be expected to be important, as with sugar, in bringing about a lower uncontrolled price for non-quota wool.

Wheat and Cotton

Similar programs for wheat and cotton are contemplated as for sugar, tobacco, and wool. With substantial exports, the lowering of the price for non-quota wheat and cotton to a free-market level would have important secondary effects insofar as sales in the world market are concerned.

Economic Implications

The significant economic implications of the described program stem from the provision for conversion of the premiums over free-market prices to readily marketable property, and for gradual reduction of premiums through government purchases of these property rights. Conversion of the premiums farmers now receive under "price-support" legislation to marketable property removes this source of revenue from the calculations of the farmer in determining his most profitable output. Thus the optimum output on each farm will be unaffected as a result of providing aid to farmers. The provision of adequate markets in which these premiums or quotas can be bought and sold will tend to cause the commodities to be produced in the areas on the farms by the farmers with the lowest production costs. The purchases of quotas by the government and the corresponding decreases in premiums paid will tend to bring about the same use of output as would be found in an economy employing uncontrolled markets. Thus the adoption of this type of program has within it the possibility of increasing the efficiency of the economy.

Under the program as outlined, tariffs, import quotas, export subsidies, government purchases under high-level supports, and multiple-price disposal plans can be eliminated for the commodities included in the new plan for transferable marketable quotas. These commodities can be sold at home and abroad freely, and domestically trade barriers will not be needed to keep out imports. And no U. S. producer would be worse off by the change in program.[8]

Of the commodities used as examples, the possible gains on fluid milk probably are relatively the least. In most markets, the "controlled" blend price is not much higher than the equilibrium price to be expected in an uncontrolled market. Therefore, just as quotas and machinery for the sale thereof are not recommended for eggs, poultry, potatoes, and meat, quotas are not recommended for such fluid milk markets as Chicago and New York. In markets like Buffalo and Rochester, New York, however, the program suggested appears workable as a means for extrication from a situation in which producers, distributors, and consumers alike either are or have cause for being very unhappy. The program suggested for these markets, even if second best to a substantial decrease in the Class I price, offers a way out which would be acceptable to all groups and, over time, achieve both lower retail milk prices and higher producer returns.

The gains are relatively more substantial for sugar, wool, wheat, cotton,

[8] No account is taken of the possible loss by persons not now farming and who might want to farm in the future or to farmers who otherwise might have expanded their output at some future date.

and tobacco. Likely, they would be substantial for some other commodities.

On wheat, cotton, and tobacco, if we, as a government, insist on high-level support prices and production quotas, the program suggested provides a means whereby resulting dislocation can be minimized. Production acreages frozen by farms, counties, states, and regions under a rigid quota system are unfrozen by the suggested program. Exports and imports can move freely. Increased use of substitutes for cotton, and, to a lesser extent, for wheat are no longer favored by high-level support prices under the suggested program.

In summary, the writers repeat again that they are using a "least-worst" criterion. We have used various techniques of control, culminating in rigid production quotas, for many important commodities. The writers endorse neither these techniques nor quotas. But, notwithstanding protests of economists, quotas will be used in the United States to a greater extent in 1954 than in any year since the outbreak of World War II. Therefore, the writers suggest that their use be improved, to make them less of a monster, by making them transferable and establishing a ready market for their purchase and sale.

Both short-run stability of prices and movement toward long-run equilibrium in prices and output would be achieved by the program. The cost of the program would, of course, be borne by the consumer and taxpayer, but the cost would be no greater than at present, and reduced costs could be looked forward to in each succeeding year as increases in efficiency were realized.

Perhaps through the suggested program farmers can let go of the bear's tail without taking a painful tumble, and the public interest can be served.

THE RELATIONSHIP BETWEEN THE BAE LEVEL-OF-LIVING INDEXES AND THE AVERAGE INCOMES OF FARM OPERATORS

VERNON W. RUTTAN*
Government Relations and Economics Staff
Tennessee Valley Authority

New Level-of-Living Indexes Now Available

THE Bureau of Agricultural Economics has recently extended its "Farm-Operator Family Level-of-Living Indexes" for counties in the United States to cover the years 1930 and 1950[1] in addition to the previously published estimates for 1940 and 1945.[2]

In spite of the widespread use of the "Hagood" indexes as indicators of the level of welfare of rural people,[3] there has been little effort to compare this index with other measures of rural welfare, such as Staab and Harris[4] have done with the "Sewell" status scale.[5] Most of the discussion of the "Hagood" index in the literature relates to the methods used in constructing the index and deriving the weights for the indexes.[6]

---

* Lewis Sinclair of the TVA Government Relations and Economics Staff is responsible for the statistical calculations presented in this paper. D. Gale Johnson, Department of Economics, University of Chicago; F. W. Williams, Department of Statistics, University of Tennessee; John Peterson, Robert E. Lowry and John Krutilla, Government Relations and Economics Staff, and Stephen C. Smith, Agricultural Economics Branch, TVA, have contributed helpful criticism and comments.

[1] Margaret J. Hagood, *Farm-Operator Family Level-of-Living Indexes for Counties of the United States: 1930, 1940, 1945 and 1950* (Bureau of Agricultural Economics; Washington: 1952).

[2] Margaret J. Hagood, *Farm-Operator Family Level-of-Living Indexes for Counties of the United States, 1940 and 1945* (Bureau of Agricultural Economics; Washington: May 1947).

[3] Cf. T. W. Schultz, *Economic Organization of Agriculture* (New York; McGraw-Hill, 1953) pp. 152-55; E. A. Schuler and W. C. McKain, Jr., "Levels and Standards of Living" in *Rural Life in the United States*, Carl Taylor, ed. (New York; Knopf, 1949); *Low Income Families and Economic Stability*, Joint Committee Economic Report, Eighty-first Congress, First Session, 1949, p. 43.

[4] Mary Jordon Harris and Josephine Staab, "The Relationship of Current Net Income to the Socioeconomic Status of Southern Farm Families," *Rural Sociology*, vol. 16, no. 9 (Dec. 1951) pp. 353-58.

[5] William H. Sewell, *The Construction and Standardization of a Scale for the Measurement of the Socio-Economic Status of Oklahoma Farm Families* (Stillwater, Oklahoma; Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Technical Bulletin No. 9; 1940). It should be emphasized that the purpose and content of the "Sewell" socio-economic status scale is quite different than the "Hagood" level-of-living index. The "Sewell" scale is designed "to give quantitative expression to the nature and extent of the variations existing in the socio-economic status" of individual farm families (p. 7). The definition of socio-economic status employed by Sewell includes the four components: cultural possessions, effective income, material possessions and participation in group activities of the community.

[6] See, for example, the articles by Margaret J. Hagood, "Construction of County Indexes for Measuring Change in Level-of-Living of Farm-Operator Families, 1940-45," *Rural Sociology*, vol. 12, no. 2 (June 1947) pp. 193-99; and "Development of a

In this paper it will be shown that the "Hagood" index is not closely related to at least one other measure of rural welfare—average net income per farm operator—except in the South. Even within the South, it seems likely that there is little relationship between the two measures in the higher income counties.

This is not to imply that either the level-of-living index or the income measure can not be extremely useful if employed with a clear recognition of what each does and does not measure. It is clear, however, that the two measures cannot be regarded as satisfactory substitutes for each other.

What Do the Level-of-Living Indexes Reflect?

The items on which the BAE farm-operator family level-of-living indexes are based are:

1. Percent of farms with electricity.
2. Percent of farms with telephones.
3. Percent of farms with automobiles.
4. Average value of products sold or traded in the year preceding the census.[7]

It should be noted that the index attempts to measure only the *farm-operator family level of living*. It is not constructed to reflect the level of living of all rural farm families. Hired farm workers and their families make up a substantial share of the rural farm population[8] and in many

1940 Rural-Farm Level-of-Living Index for Counties," *Rural Sociology*, vol. 8, no. 2 (June 1943) pp. 148-60; also the chapter on "Some Uses of Factor Analysis in Sociological Research" in Margaret J. Hagood and Daniel O. Price, *Statistics for Sociologists* (New York: 1952; Henry Holt) pp. 523-47.

[7] For 1950 the several items were weighted as follows:

$I = .538X_1 + .603X_2 + .617X_3 + .319X_4$

where I — level-of-living index

X_1 — percent of farms with electricity

X_2 — percent of farms with telephones

X_3 — percent of farms with automobiles

X_4 — average value of products sold or traded in 1949

X_4 was adjusted to take care of price changes in earlier years.

For a fuller discussion of the weighting technique, see Hagood, *op. cit.* (1952) p. 76-7.

[8] It is difficult to determine the quantitative importance of hired farm workers and their families in the rural farm population. Comparison of the Census of Population estimate of the number of rural farm families in 1950 (6,058,180) with the Census of Agriculture estimate of the number of farm operators in 1950 (5,379,250) would indicate that only about 11 percent of the families classified as rural farm would not be classified as farm-operator families. In 1950, however, the BAE estimated that out of a total farm labor force of 10.4 million workers, 2.3 million, or 17.4 percent, were hired workers (*Agricultural Statistics*, 1952, p. 638). The Bureau of the Census, in the 1950 *Annual Report on the Labor Force* (p. 23) estimated that there was an average of 1.5 million male wage and salary workers in agriculture as compared to 4.1 million male self-employed workers (i.e., farm operators) and 0.7 million male unpaid family workers. Thus, 24 percent of all male workers employed in agriculture were wage or salary workers according to the ARLF estimates.

areas receive considerably lower incomes than farm operators and their families.

Even as a measure of the level of living of *farm-operator* families, the BAE level-of-living index has several deficiencies. Mrs. Hagood has pointed out that gross farm income is not an entirely adequate indicator of the actual funds available or spent for consumption purposes.[9] The relation between gross value of sales and net income available for family living varies substantially by type of farming area and over time.[10]

There has been almost no discussion, however, of the fact that the index does not take into account the *quantity* of electricity, or of the *quality* of the automobile or other consumption items used by farm-operator families except as *quality* and *quantity* are correlated with the value of farm products sold during the preceding year.

Because of the heavy weight given to the simple possession of automobile, telephone and electrical service, one would expect a simple linear relationship to exist between the BAE farm-operator level-of-living index and the average net income of farm-operator families only when such items or services are possessed by a relatively small number of farm families. As large numbers of farm families come to possess such items and services and begin to increase the *quantity* and *quality* of their consumption (by adding such items as electric refrigerators and stoves, higher priced automobiles, etc.), one might expect that this relationship would take on a curvilinear form or disappear altogether.

Comparison with Income Measures

In an attempt to test the above hypothesis, two regression equations, a linear equation ($I = a + b\ Y$) and a parabola ($I = a + bY + cY^2$) were fitted to State average farm-operator level-of-living indexes for 1930, 1940 and 1950 and estimated average net income per farm from agriculture and government payments[11] for the previous year. Comparison of the level-of-living index to average net income in the previous year is con-

[9] Margaret J. Hagood and Louis J. Ducoff, "What Level-of-living Indexes Measure," *American Sociological Review*, Vol. 9, no. 1 (February 1944) p. 83.

[10] Margaret J. Hagood, "Indexes of Levels of Living for Counties and Other Geographic Areas." (Paper read at the 30th Annual Agricultural Outlook Conference, Washington, D. C., Oct. 21, 1952) p. 3. The sizable nature of these variations can be illustrated by two comparisons: (a) In Lumpkin County, Georgia, a poultry raising county where feed costs represent an important cost item, net farm income (including the estimated value of food consumed on farm where produced) represented only 64 percent of the value of farm products sold in 1949. In Lauderdale County, Alabama, an important cotton producing county, net farm income is 97 percent of the value of farm products sold. (b) Between 1929 and 1949 sales of farm products rose by 245 percent in 125 Tennessee Valley counties, while net farm income rose by only 145 percent. The difference reflects, to a large extent, the higher production expenses that result from a more commercialized agriculture.

[11] State data for 1929 and 1939 are from "Net Income and Production Expenses of Farm Operators by States, Calender Year 1929, 1939-44." *Income Parity for Agricul-*

TABLE 1. RELATIONSHIP BETWEEN THE BAE FARM-OPERATOR FAMILY LEVEL-OF-LIVING INDEXES AND THE AVERAGE NET INCOMES PER FARM FROM FARMING: 1930, 1940 AND 1950

Year	Equation	Coefficient of Determination	Standard Error	F Ratio[a]
	Curvilinear Relationship—46 States[b]			
1930	$I=-77.08+.1437Y-.0000263Y^2$	.82	17.97	23.27
1940	$I=-75.35+.15378Y-.0000295Y^2$	.57	21.80	14.73
1950	$I=\ 34.46+.04291Y-.0000035Y^2$	.55	22.23	22.04
	Linear Relationship—46 States[b]			
1930	$I=21.15+.0356Y$	.48	22.81	—
1940	$I=27.74+.0364Y$	.41	25.82	—
1950	$I=92.83+.0108Y$	.31	29.97	—
	Curvilinear Relationship—201 Tennessee Valley Region Counties			
1950	$I=6.26+.090559Y-.000228Y^2$	.58	16.25	19.45
	Linear Relationship—201 Tennessee Valley Region Counties			
1950	$I=39.08+.033Y$	.28	17.03	—

[a] On the basis of data from 46 states an F ratio greater than 4.07 is evidence (at the .05 level) that the particular relationship fitted (a parabola) provides a significantly better description of the relationship between two variables than a straight line. For the 201 Tennessee Valley region counties, an F ratio of only 3.89 is required.

[b] Farm-operator family level-of-living indexes are not available for two States—Arizona and New Mexico.

sistent with Mrs. Hagood's practice of using the average value of products sold or traded in the year preceding the census in her equation. The average net farm income figures for all three years were expressed in terms of 1949 purchasing power by inflating the 1929 and 1939 average farm incomes to the 1949 level.[12] Thus, both the level-of-living indexes and the average net farm income estimates are expressed in *real* terms.

Examination of the results of these comparisons (Table 1) indicates that in each of the years 1930, 1940 and 1950, a simple parabola provides a significantly better description of the relationship between the two measures of rural welfare than a straight line.[13]

ture, part VI, section 1 (Washington: U.S. Department of Agriculture, Bureau of Agricultural Economics, 1949) p. 22. The 1949 estimates are obtained by dividing U.S. Department of Commerce unpublished estimates of net farm income by states for 1949 by the number of farms as reported in the U.S. Bureau of the Census preliminary release, AC 50-2, April 9, 1952.

[12] The index of prices paid by farmers for all commodities bought for use in family maintenance was used to inflate the 1929 and 1939 average farm income estimates to the 1949 level. This index is presented in *Agricultural Statistics*, 1952, p. 684.

[13] It will be noted in table 1 that even though the coefficients of determination are larger in the case of the curvilinear than the linear relationship all are rather low, except for the coefficient of determination obtained for the parabolic relationship in 1930. A part of this low correlation between the level-of-living index and average income per farm may be due to the year-to-year variability in farm income which tends to be smoothed out in the level-of-living index. The curvilinearity of the relationship should not, however, be affected by the year-to-year variability in income.

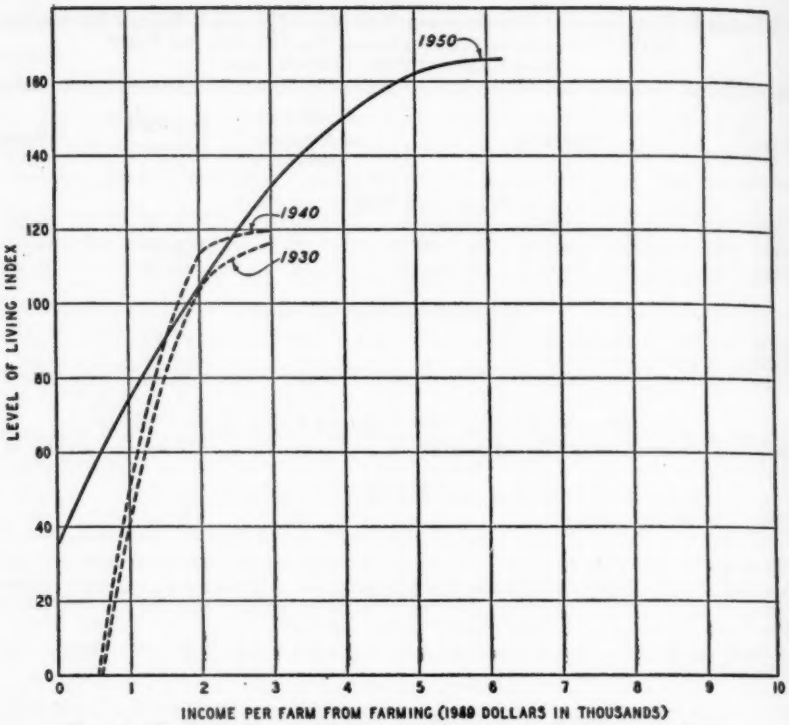

FIG. 1. The curvilinear relation by states: 1930, 1940 and 1950

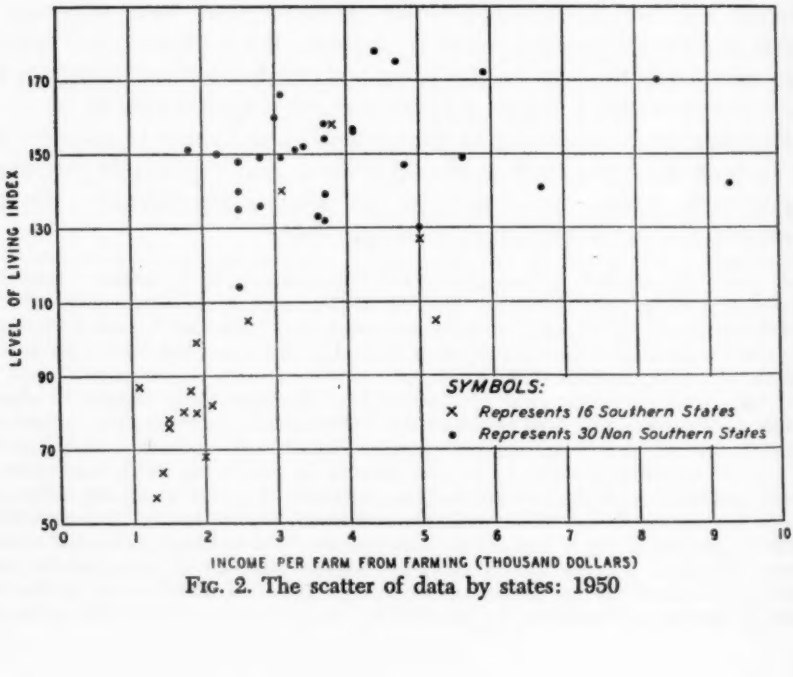

FIG. 2. The scatter of data by states: 1950

In Figure 1 the relationships between the two indicators of rural welfare, as defined by the fitting of a simple parabola, are plotted. In both 1929 and 1939 there was almost no relationship between the State average level-of-living indexes and the average net income per farm in the income range above $3000. In 1950 the parabola begins to level off only after an average income of slightly above $6000 per farm is achieved. A glance at Figure 2, where the data for each State are presented, however, seems to indicate that the curve would have leveled off at an average income per farm somewhere in the neighborhood of $3000, if a parabola of the form $I = a + bY + cY^2 + dY^3$ had been fitted rather than a simple parabola.

One of the striking features brought out by Figure 2 is the fact that there is almost no relationship between the level-of-living index and average net farm income in 1950 except in the States of the South.[14]

Furthermore, examination of the dot diagrams for all three years seems to indicate that the rather striking shift (see Figure 1) of the parabola between 1940 and 1950 is due to the fact that outside of the South the level-of-living index failed to shift upward anywhere near as rapidly as average income per farm during the 1940-50 decade.[15] The implication is, of course, that the level-of-living index is sensitive to those factors which make important contributions to the level of living of rural people only in the lower income areas or in areas where the distribution of income (and facilities) is highly unequal, as among farm-operator families.[16]

The fact that we have been forced, by the nature of the data available, to compare an index representing the *average* level-of-living of farm-operator families with the *average* income per farm from farming rather than the *average* income per farm family *from farm and nonfarm sources,* places a definite limitation on the above comparisons.

---

[14] The linear relationship between the level-of-living index and average net farm income for 16 southern States (indicated by X's on figure 2) for 1950 was $I = 55.73 + .015873Y$ with a standard error of 20.2 and a coefficient of determination of .48. For 30 non-southern States (indicated by dots in figure 2) the relationship was $I = 141.92 + .001885Y$ with a standard error of 14.16 and a coefficient of determination not significantly different than 0 (at the .001 level).

[15] Between 1940 and 1950 the average level-of-living index in the South rose from 49 to 92, an increase of 88 percent. Between 1939 and 1949 the average income per farm from farming (in 1949 dollars) rose from $1193 to $2364, an increase of 98 percent. For the nation as a whole, the level-of-living index rose from 79 to 122, an increase of 54 percent, while average income per farm from farming (in 1949 dollars) rose from $1488 to $3432, an increase of 131 percent during the same period.

[16] The fact that three of the four items included in the index reflect the percent of farm-operator families possessing certain specified items does give the index the facility of discriminating between two counties with identical average farm incomes but quite different distributions of income. This is a definite advantage in any measure of rural welfare. This advantage is probably less pronounced in relation to the median income of rural farm families.

TABLE 2. RELATIONSHIP BETWEEN THE BAE FARM-OPERATOR FAMILY LEVEL-OF-LIVING INDEXES AND THE CENSUS OF POPULATION ESTIMATES OF THE MEDIAN INCOME OF RURAL FARM FAMILIES BY STATES IN 1950

Year	Equation	Coefficient of Determination	Standard Error	F Ratio[a]
	Curvilinear Relationship—46 States[b]			
1950	$I = -15.10 + .10622Y - .00001572Y^2$	.85	13.01	7.21
	Linear Relationship—46 States[b]			
1950	$I = 32.20 + .04794Y$	.82	14.43	—

[a] On the basis of data from 46 states, an F ratio greater than 4.07 is evidence (at the .05 level) that the particular relationship fitted (a parabola) provides a significantly better description of the relationship between the two variables than a straight line.

[b] Farm-operator family level-of-living indexes are not available for two States—Arizona and New Mexico.

However, examination of the relationship between the BAE farm-operator level-of-living index and the Bureau of the Census State estimates of the *median income* of *all* rural farm families in 1950[17] (see Table 2) lends strength to the conclusions that (a) the total relationship is curvilinear rather than linear, and (b) almost no relationship exists between the level-of-living indexes and farm family income outside of the South.[18]

It is apparent from Table 2 that in the above comparison the superiority of the curvilinear relationship over the linear, although significant at the .05 level, is not nearly as pronounced as in the comparisons between the level-of-living index and average income per farm from farming.[19] One should bear in mind, however, the commonly observed tendency for the distribution of income to be skewed to the right with the result that the *median* income is significantly smaller than the *mean*.[20] This fact prevents

[17] U.S. *Census of Population, 1950,* vol. 2. (1950 is the first year for which the median income of rural farm families by states is available.)

[18] The relationship between the level-of-living index and the median income of rural farm families for 16 southern States for 1950 was $I = 3.40 + .06915Y$ with a standard error of 12.13 and a coefficient of determination of .832. For 30 non-southern States, the relationship was $I = 93.38 + .02306Y$ with a standard error of 67.34 and a coefficient of determination of .28.

[19] It has been suggested that a comparison between the 1950 level-of-living index and estimates of the median income of rural farm families in 1949 for a sample of all U.S. counties would provide a further test of the relationship between the two measures of rural welfare. In view of the results obtained from the above comparison (table 2) and the fact that the median income estimates are limited by a failure to include the value of home consumption of farm products, such a comparison hardly seems worth the additional effort involved in estimating the median incomes (which are not published by the Census) and making the additional comparisons.

[20] See, for example, George Garvy, "Inequality of Income: Causes and Measurement," *Studies in Income and Wealth,* vol. 15. See especially pp. 33-36 and the literature cited. See also, *Consumer Incomes in the United States* (National Resources Committee, 1938) p. 6.

one from ascribing the relatively small improvement in the fit of the curvilinear regression entirely to inclusion of the nonfarm income of rural farm families.

Although a linear equation might adequately describe the relationship between the "Hagood" farm-operator level-of-living index and the average net income of farm operators from agriculture and government payments in the 16 southern States (Figure 2), there is evidence to suggest that a curvilinear equation would best describe this relationship for counties within the South. Comparison of the "Hagood" index with estimated average income per farm worker for 201 Tennessee Valley region counties[21] indicates that the simple parabola describes the relationship between these two indicators of rural welfare in 1950 somewhat more closely than it describes the relationship between the level-of-living index and either the average net income per farm or the median income of rural farm families in 1950 for the states of the nation.

Index Has Limited Usefulness at Present

The material presented in the previous section indicates that as the average net income of farm operators from agriculture and government payments increases the relationship between this measure of rural welfare and the BAE level-of-living index becomes increasingly tenuous. Only in the lower income states and counties are the two measures of rural welfare closely related. It would seem, therefore, that if the index is to continue to serve as a general purpose index for nation-wide comparisons rather than an index primarily applicable to the low income and subsistence farming areas, it would be desirable to incorporate additional factors which reflect the higher levels of living which farm operators in the more commercial sectors of American agriculture can now afford.

[21] The average income per farm worker in Valley region counties was obtained by dividing the estimated total net farm income from farming in each county by the number of workers employed in agriculture. This definition of total net farm income is consistent with the Department of Commerce estimates. The estimates were derived by procedures outlined in Lewis C. Copeland, *Methods for Estimating Income Payments in Counties* (University of Virginia, Charlottesville, Va.). The farm employment estimates are based on Census of Population data adjusted for seasonal variation.

THE MANPOWER SITUATION IN SOUTHERN AGRICULTURE*

LOUIS J. DUCOFF AND JOE R. MOTHERAL
United States Bureau of Agricultural Economics

A MAJOR share of the national interest in manpower problems long ago turned to the South as a region and to southern agriculture as a particular feature of the regional perspective. An imbalance of resources is generally assumed to prevail in the South, but perhaps the real magnet of interest in recent years has been the dynamics of adjustment. Industrial development, inter-regional migration, and farm technology have combined to make of the South a laboratory for the study of basic economic change.

It is not possible in this paper to do an exhaustive analysis of the varied implications of the whole, resurgent southern economy. Rather, an attempt is made here to measure some of the major realignments in manpower use in southern agriculture and to appraise a few outstanding consequences. Sufficient data never are available even for so limited an objective. But the main sources have been tapped for a factual presentation. Besides the Censuses, these include the farm employment and wage rate series of the Bureau of Agricultural Economics and the results of a program of farm manpower research carried out by BAE in cooperation with the Bureau of Employment Security and Land-Grant colleges.

Between 1940 and 1952 farm employment in the United States decreased by more than 2,000,000 workers, or about one-fifth. The decrease took place among all categories of farm workers, including farm operators, unpaid family workers, and hired farm workers. This substantial decline was the result of extensive migration from farms under war and postwar conditions of full employment in the economy as a whole, widespread gains in mechanization of agriculture, and a reduction in the number of farms. During these same years, however, total farm output increased by some 30 percent and farm output per man hour of labor rose by more than half over that in 1940.

These national trends in the size and productivity of the farm working force reflect corresponding trends in all regions of the country. However, the South experienced more than half of the nation's decrease in number of farms, size of the farm population, and level of farm employment. Nearly 60 percent of the United States' decrease in the rural-farm population in the decade 1940 to 1950 and about three-fifths of the decrease in number of farms occurred in 13 southern States.

Between 1940 and 1952 the size of the farm working force in the South

* Revision of a paper presented at the 50th Annual Convention of the Association of Southern Agricultural Workers, New Orleans, Louisiana, February 11, 1953.

decreased at a greater rate than in other major regions of the country (Table 1). The decrease of 27 percent in total farm employment in the South between 1940 and 1952 compares with decreases of 22 percent in the Northeast, 14 percent in the North Central States, and 10 percent in the West. In the case of hired farm workers the South's decrease of one-third was matched only by that in the North Central States.

Relative increases in farm output since the years before World War II varied in the several areas of the South. Thus in 1951 the volume of farm output of commodities for human use was 50 percent above the 1935-39 average in the South Atlantic States, but only 16 percent higher in

TABLE 1. CHANGES IN FARM EMPLOYMENT, UNITED STATES AND MAJOR REGIONS, ANNUAL AVERAGES, 1940, 1945, 1950 AND 1952[a]

Area	Number in thousands				Percent change		
	1940	1945	1950	1952	1940 to 1952	1940 to 1945	1945 to 1952
United States							
All farm workers	10,979	10,000	9,342	8,669	−21.0	− 8.9	−13.3
Hired farm workers	2,679	2,119	2,090	1,921	−28.3	−20.9	− 9.3
Northeast							
All farm workers	914	851	764	714	−21.9	− 6.9	−16.1
Hired farm workers	282	239	229	211	−25.2	−15.2	−11.7
North Central							
All farm workers	3,408	3,215	3,105	2,920	−14.3	− 5.7	− 9.2
Hired farm workers	634	455	467	416	−34.4	−28.2	− 8.6
South							
All farm workers	5,552	4,822	4,438	4,040	−27.2	−13.1	−16.2
Hired farm workers	1,289	949	944	858	−33.4	−26.4	− 9.6
West							
All farm workers	1,105	1,112	1,035	995	−10.0	+ .6	−10.5
Hired farm workers	474	476	450	436	− 8.0	+ .4	− 8.4

Source: United States Bureau of Agricultural Economics.
[a] Revised series.

the East South Central and the West South Central States (Table 2). For the country as a whole the 1951 farm output was 39 percent higher than in 1935-39. Farm output per man hour of labor input in 1951 was 51 to 56 percent above the pre-World War II average in each of the three southern geographic divisions. This rate of progress in agricultural labor productivity in the South was not much under the national average of 62 percent and was higher than in some other areas of the country.

To examine recent trends in the agricultural manpower situation in the South, it is desirable to analyze the trends in the different States of the South because of diversity of conditions within the Region as a whole. To

do that, however, it is necessary to restrict oneself to the types of data contained in the Censuses of Population and of Agriculture since State data relevant to farm manpower are available only from Census sources, except for limited special studies that have been made by the Bureau of Agricultural Economics or other agencies. An examination of the 1950

TABLE 2. INDEX NUMBERS OF TOTAL FARM OUTPUT[a] AND OUTPUT PER MAN-HOUR, UNITED STATES AND GEOGRAPHIC DIVISIONS, 1940, 1950, AND 1951

Division	Farm output, 1935–39=100		
	1940	*1950*	*1951*[b]
United States	110	136	139
New England	105	133	129
Middle Atlantic	103	127	130
East North Central	107	132	137
West North Central	122	159	154
South Atlantic	109	133	150
East South Central	95	112	116
West South Central	113	114	116
Mountain	113	147	151
Pacific	108	142	148
	Output per man-hour, 1935–39=100		
United States	112	164	162
New England	107	141	140
Middle Atlantic	104	140	144
East North Central	109	161	169
West North Central	121	189	186
South Atlantic	110	149	156
East South Central	102	151	155
West South Central	115	158	151
Mountain	112	160	159
Pacific	107	132	130

[a] Farm output is gross farm production minus farm-produced power of horses and mules. The indexes of farm output measure calendar-year production of farm products for human use.

[b] Preliminary.

Source: United States Bureau of Agricultural Economics.

and the 1940 Censuses reflects rather significant changes during this eventful decade. Attention is focused in this paper on the 13 States which are included in the West and East South Central States and in the South Atlantic Division, excluding Delaware, Maryland, and West Virginia.

The number of farms decreased between 1940 and 1950 in each of these States except North and South Carolina, in which small percentage gains occurred. For the 13 southern States as a whole, the number of farms decreased by about 330,000 or 12 percent (Table 3). The largest percentage decreases occurred in the West South Central States, averaging

19 percent fewer farms than in 1940. Mississippi, Kentucky and Virginia each had decreases of approximately 14 percent. Almost all the decrease in number of farms occurred among those units operated by sharecroppers and other tenants. The number of full and part owners increased between 1940 and 1950 in the Region as a whole and in each State. The total number of sharecroppers declined by nearly 200,000 or 36 percent, and the number of other tenants dropped by 330,000 or 38 percent. Decreases of 40 percent or more in the number of sharecroppers occurred in Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas. Decreases

TABLE 3. PERCENTAGE CHANGES FROM 1940 TO 1950 IN NUMBER OF FARMS, SHARECROPPERS, FARM WORKERS, AND TRACTORS ON FARMS, 13 SOUTHERN STATES AND 3 SOUTHERN REGIONS

State	Percent change 1940–1950 in number of			
	Farms	Share-croppers	Total farm workers[a]	Tractors
13 southern States	−11.5	−35.9	−18.2	+203
South Atlantic[b]	− 4.0	−19.8	−16.5	+403
East South Central	−10.8	−38.0	−17.0	+417
West South Central	−19.1	−53.6	−21.0	+154

[a] Relates to persons doing farm work during last week of March 1940 and week preceding census enumeration in 1950. Includes farm operators, unpaid family workers, and hired farm workers.

[b] Excludes Delaware, Maryland, and West Virginia.

Source: 1950 Census of Agriculture.

from 30 to nearly 40 percent occurred in Virginia, Kentucky, and Tennessee. In North and South Carolina declines of only small proportions in the number of sharecroppers occurred, 12 percent in South Carolina and 5 percent in North Carolina. In some of these States the large absolute and percentage decrease in sharecroppers probably resulted in a shift toward relatively greater use of wage labor in 1950 than a decade earlier.

Indications of extensive mechanization on farms in the southern States are provided by Census data on number of tractors on farms and by other supporting information. For the country as a whole the number of tractors on farms in 1950 was about two and one-half times the number in 1940 (Table 3). For the 13 southern States, however, the number of tractors tripled. In the South Atlantic and East South Central States there were five times as many tractors on farms. Only in Oklahoma and Texas was the number of tractors in 1950 less than two and one-half times the number in 1940.

More recently, mechanization of the cotton harvest has begun to make noticeable progress in a number of cotton areas. Thus, while in 1949 only 6 percent of the United States cotton crop was mechanically harvested, this percentage increased to 8 in 1950, to 15 in 1951, and to 18 in 1952

(Table 4). The most rapid progress in mechanization of the cotton harvest has taken place so far in the Western cotton areas of Arizona and California, where 46 and 59 percent, respectively, of the cotton crop was mechanically harvested in 1952. In 1949 Arizona had only 4 percent of its cotton crop mechanically harvested while California had only 13 percent.

TABLE 4. PERCENTAGE OF COTTON CROP MECHANICALLY HARVESTED, BY STATES, 1949–1952[a]

AREA	1949	1950	1951	1952
	Percent	*Percent*	*Percent*	*Percent*
United States	6	8	15	18
Alabama	*	*	*	1
Arizona	4	9	26	46
Arkansas	1	1	2	2
California	13	34	53	59
Florida	0	0	1	4
Georgia	*	*	2	3
Louisiana	*	3	11	13
Mississippi	4	3	7	7
Missouri	2	*	1	6
New Mexico	3	1	7	12
North Carolina	*	*	1	1
Oklahoma	2	6	13	17
South Carolina	1	*	3	1
Tennessee	*	*	*	1
Texas	11	12	19	22
Virginia	0	0	0	0

* Less than 0.5 percent.

[a] Includes machine picking and machine stripping.

Source: *Charges for Ginning Cotton and Related Data*, U. S. Dept. of Agriculture, PMA, April 1950, April 1951, April 1952, and April 1953.

Of the 13 cotton States dealt with in this paper, Texas showed the largest use of mechanical harvesting with 22 percent of its 1952 crop thus harvested, Oklahoma 17 percent, and Louisiana 13 percent.

The downward trend in number of farms and the gains in mechanization have contributed to the downward trend in the number of persons working on farms in the southern States during the decade or so examined here. According to the Census of Agriculture, total farm employment decreased between 1940 and 1950 from 20 to 27 percent in Georgia, Alabama, Mississippi, Arkansas, Louisiana, and Texas.[1] For the 13 south-

[1] State changes in farm employment between 1940 and 1950 are revealed by data obtained in the Census of Agriculture as well as in the Census of Population. Because of noncomparabilities in the concepts and measurement of agricultural employment in the two Censuses, the actual level of farm employment as well as the percentage changes are different in the two Censuses. The nature of the differences in concepts of employment used in the Population Census is such as to lead to both a lower absolute level of employment and a greater percentage decrease than shown by the data from the 1940 and 1950 Censuses of Agriculture. Both sources, however, are consistent in showing a decline in farm employment between 1940 and 1950. Also,

ern States as a group, the decrease was 18 percent. The smallest decreases in farm employment—8 to 10 percent—occurred in North Carolina, Florida, and Tennessee. The levels of agricultural employment shown by the Censuses of Agriculture relate to the last week of March in 1940 and to the week preceding the visit of Census enumerator in 1950 which generally occurred during April or May of that year. The farm employment levels at both Census dates relate to the early spring situation, and are thus lower than would have been encountered during a busier part of the year or the annual average of farm employment in these States.

Trends in the Use of Hired Labor and in Wage Rates on Southern Farms

Estimates of man-days of hired labor used on farms in each of the 3 southern regions during the calendar years 1939, 1944, and 1949 are presented in Table 5. Hired labor input increased, between 1939 and 1949,

TABLE 5. ESTIMATED MAN-DAYS OF HIRED LABOR USED ON FARMS, 13 SOUTHERN STATES AND 3 SOUTHERN REGIONS, 1939, 1944, AND 1949[a]

	Number of days			Percent change		
	1939	1944	1949	1939–1944	1944–1949	1939–1949
	Millions	*Millions*	*Millions*	*Percent*	*Percent*	*Percent*
13 southern States	236.4	216.1	244.7	− 8.6	+13.2	+ 3.5
South Atlantic[b]	81.2	72.1	64.3	−11.2	−10.8	−20.8
East South Central	43.5	39.0	46.8	−10.4	+20.0	+ 7.6
West South Central	111.7	105.0	133.6	− 6.0	+27.2	+19.6

[a] Estimates derived from total cash farm wage expenditures reported in 1940, 1945, and 1950 Censuses of Agriculture and BAE data on farm wage rates. Due to rounding, components do not always add to the totals shown.

[b] Excludes Delaware, Maryland, and West Virginia.

by 20 percent in the West South Central States, and by 8 percent in the East South Central States. These increases were due partly to extensive shifts from sharecropping to wage labor and partly to increased cotton production—especially in Arkansas, Texas, and Mississippi. In the South Atlantic States, the volume of hired labor used declined 21 percent between 1939 and 1949; two of the States in this region, South Carolina and Georgia, registered decreases of nearly one-third.

As a major factor in the changing labor-use pattern, adjustments in cotton production in the southern States are noteworthy. In Texas cotton production was more than twice as large in 1949 as in 1939, while in Arkansas cotton production was 17 percent greater. In Mississippi the shift from sharecropping to wage labor may have been an important

States which show large decreases between 1940 and 1950 according to the Census of Agriculture are generally States in which large decreases are shown by the Census of Population.

factor, since the volume of cotton production in 1949 was slightly under that in 1939, though the acreage harvested was somewhat greater in the latter year.

Changes in farm wage rates tend to reflect prevailing conditions of farm labor supply and demand. Between 1940 and 1952 farm wage rates increased sharply and were almost four times as high in 1952 as in 1940 for the country as a whole. In general, regions with lower farm wage rates increased percentage-wise to a greater extent than areas in which wage rates were higher to start with. Thus, in the South Atlantic, East and West South Central States, farm wage rates in 1952 were nearly four

TABLE 6. FARM WAGE RATES, UNITED STATES AND MAJOR GEOGRAPHIC DIVISIONS, 1940 AND 1952

Area	Composite cash farm wage rate in cents per hour		Percent increase 1940 to 1952
	1940	1952	
	Cents	*Cents*	*Percent*
United States	17.1	66.1	287
New England	26.5	80.2	203
Middle Atlantic	22.3	73.4	229
East North Central	19.3	72.6	276
West North Central	18.1	77.7	329
South Atlantic	12.6	50.9	304
East South Central	11.8	45.7	287
West South Central	13.4	60.8	354
Mountain	20.2	78.1	287
Pacific	31.8	102.9	224

Source: United States Bureau of Agricultural Economics.

to four and one-half times as much as in 1940. In these States the average hourly cash earnings of hired farm workers increased from approximately 12 to 14 cents in 1940 to an average of 46 to 61 cents in 1952 (Table 6). In the highest farm wage area in the country—the Pacific States—farm wage rates more than tripled between 1940 and 1952. In these States the hourly cash earnings of hired farm workers climbed from an average of 32 cents in 1940 to approximately $1.03 in 1952.

Notwithstanding these striking percentage gains in farm wage rates in the South during the last 12 years, the gap in rates expressed in cents paid per hour between South and nonsouth actually widened (Table 7). While average wages in the South were rising 39 cents per hour they were rising 58 cents per hour in the nonsouth. Expressed as a percentage of nonsouthern rates, however, southern rates showed a slight upward trend from 61 to 66 percent between 1940 and 1952.

Some Effects of the Post-Korean Defense Program

The return of many servicemen and war-industry workers to farms following the end of World War II, together with a slowing down of the rate of net migration from farms, temporarily reversed the downward trend in the Nation's farm population and farm employment. This phenomenon was short-lived. Release of the pent-up demand for consumer goods maintained industrial production at high levels, and the loss of farm manpower in response to urban job opportunities soon was resumed at an accelerated pace. At about the time when supplies of consumer goods were beginning

TABLE 7. TREND IN SOUTH-NONSOUTH DIFFERENTIAL IN AVERAGE FARM WAGE RATES, 1940–1952

Year	Composite cash farm wage rate in cents per hour		Percent farm wage rates in South are of those in nonsouth
	South[a]	Nonsouth[a]	
	Cents	*Cents*	*Percent*
1940	12.6	20.8	60.6
1952	51.9	78.5	66.1

[a] The South includes the South Atlantic, East South Central, and West South Central geographic divisions. The nonsouth includes all other geographic divisions.
Source: United States Bureau of Agricultural Economics.

to catch up with postwar demand, the outbreak of hostilities in Korea precipitated another large-scale rearmament program and the tempo of production once more increased both in industry and agriculture.

Since June 1950, manpower has been generally regarded as one of the critical factors in defense preparations. Of the various principal claimants for manpower, agriculture has been least successful in competing for the available supply. Stresses and strains have appeared in many farming areas, in some cases due to a deficit of qualified workers and, perhaps, in others to a failure to achieve maximum labor utilization. This situation has focused renewed interest in ways and means of achieving more effective use of labor in industry and agriculture.

The Bureau of Agricultural Economics enlarged its program of research in farm manpower problems during 1952 and 1953. Five of the Bureau's surveys in this field were carried out in the South, four in cooperation with State colleges and the fifth, covering three selected southern areas, with the Bureau of Employment Security of the Department of Labor.[2] Al-

[2] BAE also made a cooperative study involving farm manpower aspects with the North Carolina Agricultural Experiment Station in 1951. The results of this appeared in a publication by C. E. Bishop and J. G. Sutherland entitled, *Resource Use and Incomes of Families on Small Farms, Southern Piedmont Area, North Carolina.*

though the analyses have not been entirely completed, the preliminary results provide certain insights into the southern farm manpower situation that are not available from such sources as the Census.

Seasonal Employment and Unemployment

In the survey involving three southern areas, seasonal farm employment and unemployment of farm wage workers were the focal points of study. Restricted to households located in small cities, towns and villages and having one or more members who had performed some farm wage work during the preceding 12 months, this survey was centered in localities that were believed to be affected by relatively high rates of unemployment during certain periods of the year. A year's work record (May 1951-May 1952) was reconstructed and related data obtained from a sample of households in Cordele, Georgia; Pine Bluff, Arkansas; and Opelousas and other population centers in St. Landry and Evangeline Parishes in Louisiana. In each of these areas the survey households were virtually all Negro households, and cotton was by far the main source of seasonal farm work.[3]

Periodic unemployment was found to be relatively common in two of the three areas. In Cordele, Georgia, where nonfarm employment opportunities are comparatively numerous, only 11 percent of the workers in the survey group were unemployed at some time during the year. One-fourth of the workers interviewed in Arkansas, however, and slightly more than one-third of those in Louisiana, reported periods of unemployment for the year ranging up to two months or more. It was only during cotton chopping and harvesting that full utilization of the labor force covered in the survey was approached.

It is significant, too, that only 7 percent of the entire survey group reported any experience or training other than that of their usual work, which was commonly farm work. Undoubtedly, many workers with more extensive nonfarm employment histories had already moved out of the survey areas and into urban centers in the northern and West Coast regions. Such migration had two apparent consequences. First, it reduced competition for whatever out-of-season jobs were available within the survey areas and perhaps held the rate of seasonal unemployment for those who remained to a lower figure than otherwise might have been the case. Second, with continued heavy cotton plantings, it placed considerable pressure on the local labor supply during peak periods of demand for farm workers. During the cotton harvest some 2,000 outside workers, most of them Mexican Nationals, were brought into the Arkansas area; while in the Georgia area, which had traditionally supplied its

[3] See *Unemployment and Partial Employment of Hired Farm Workers in Four Areas* (a summary report), Bureau of Agricultural Economics in cooperation with the Bureau of Employment Security, U.S. Department of Labor, April 1953.

own labor force for the cotton harvest, foreign workers were employed for the first time in 1951.

Underutilization of Rural Manpower

Studies were made in Eastern Kentucky and Southeastern Oklahoma for the purpose of appraising the utilization of rural manpower in areas long identified as potential sources of labor supply for other areas.[4] Both areas are characterized by a predominantly subsistence-type farming, low incomes, high birth rates, and a dearth of local nonfarm employment opportunities. With employment opportunities elsewhere being relatively abundant, these conditions resulted in heavy out-migration. In about 6 years, 31 percent of the open country households studied in Eastern Kentucky had contributed one or more members to the outward stream of migrants who left permanently. The corresponding figure in Southeastern Oklahoma was 33 percent in 9 years. Among the households from which one or more members had left permanently, more than a third in the Kentucky sample and nearly a half in the Oklahoma sample had contributed two or more members to the out-migration. These data relate only to the movement of persons from households now residing in the area. Considering the possible additional numbers of whole-family migrations not covered in the survey (plus the heavy seasonal migration from Oklahoma), the postwar contribution of these areas to the manpower force of other parts of the country becomes impressive.

Underemployment was a common lot for many of those who remained in the open country areas of Eastern Kentucky and Southeastern Oklahoma. In the Kentucky sample, 43 percent of the male heads of farm households worked less than 150 days on the home farm between March 1951 and March 1952, and less than half did any nonfarm work. In the Oklahoma sample, less than one-third of the survey population 14 years of age and over worked as much as 180 days altogether (at both farm and nonfarm work) during 1952.

The open country population in these areas was handicapped by more than the limitations of land resources and the lack of nonfarm employment opportunities within the community. For one thing, training facilities to equip them for possible alternative employment were obviously inadequate. Among persons 14 years of age and over in the Kentucky survey group, 32 percent had done some nonfarm work during the preceding 10 years, yet only 7 percent had received any training for nonfarm work. The corresponding data for Southeastern Oklahoma showed that 38

[4] See *Utilization of Rural Manpower in Eastern Kentucky*, by Robert E. Galloway and Howard W. Beers, RS-3, Kentucky Agricultural Experiment Station in cooperation with Bureau of Agricultural Economics, January 1953. A report on the Oklahoma study is in final manuscript.

percent had done nonfarm work and only 5 percent had received training for such work. Due to selectivity in the outmigration, an abnormally large number of physically handicapped persons remained in these areas. Among the group studied in Southeastern Oklahoma, 10 percent of all the persons 14 years of age and over were either partially or totally disabled. Thus the dependency burden further complicates a situation which, despite the outward movement of population in recent years, is still characterized by a comparatively high man-land ratio.

Labor-Deficit Areas

The Texas High Plains, scene of the fourth local survey, differs markedly from the areas already discussed. Under conventional methods of harvesting cotton, the local labor supply is never sufficient during the peak season in the High Plains, and more than three-fourths of the labor force employed in the cotton harvest consists of migratory workers. The setting is one of heavy seasonal farm labor demand which at the same time is strongly conditioned by a realizable labor-saving potential. Forty percent of the crop in the two sample counties was machine-harvested in 1951, and it appeared that the capacity of harvesting equipment available in the area was sufficient to handle all of the crop provided the season were somewhat extended.[5]

This survey, conducted in February 1952, covered the 1951 crop season. In addition to exploring the relationships between labor and machine use, the project also furnished data on sources, recruitment and turnover of workers in the cotton crop of the High Plains. By far the greatest part of the labor force consisted of migrants and local workers not living on farms. Forty-two percent of the chopping and hoeing workers were from local sources, 50 percent came from outside the area; 20 percent of the harvest workers were local in origin, and 77 percent were migrants. Most of the migratory harvest workers traveled in crews, and 65 percent of the crews were composed of Latin-Americans from South Texas, for many years the principal source of the State's migratory stream. In 1951 only slightly more than 2 percent of the crew workers were Mexican Nationals.[6]

In the High Plains 32 percent of the harvest crews were reported by operators as having left their farms before the end of the season. Dissatisfaction with wage rates was the most common single reason given by the operators for this turnover, accounting for 22 percent of the crews that left early. A combination of related reasons—unsatisfactory earnings, poor fields and light yields—was advanced by operators as explaining the

[5] Joe R. Motheral, William H. Metzler, and Louis J. Ducoff, *Cotton and Manpower, Texas High Plains*, Texas Agricultural Experiment Station Bulletin 762, May 1953.

[6] The data on sources of labor were derived from numbers of workers reported by each of the 324 operators in the sample and therefore involve some multiple counting in the case of workers employed by two or more operators.

departure of another 27 percent of the crews that left early. A variety of other reasons for labor turnover proved to be less striking than wages and earnings. The loss of family and regular hired workers after the outbreak of Korean hostilities was not numerically large, as these losses had affected only 7 percent of the cotton farms in the area. However, these workers were predominantly machine operators and other comparatively skilled workers and their loss constituted a serious handicap to individual farmers.

It has been demonstrated that machine harvesting of cotton in the High Plains is economically feasible and, in fact, generally advantageous under conditions prevailing since World War II. Nevertheless, the decision by any given operator to machine harvest all or part of his crop is frequently complicated by a variety of considerations. This survey showed that tenure of the operator is probably the most significant determinant of the extent of machine harvesting. The full explanation for the tenure influence cannot be developed in the space available here, but its importance may be shown by two contrasting sets of figures. On farms operated by full owners, 68 percent of the 1951 crop was machine harvested, while only 26 percent of the crop on tenant-operated units was machine harvested. On farms within the optimum-size range for use of this equipment (125-250 acres in cotton) 82 percent of the crop on farms under operation by full owners was machine harvested, as contrasted with only 39 percent on tenant-operated farms. A study focused specifically on the tenure implications of cotton mechanization in this area offers real possibilities in the research field. Meanwhile an intensification of educational activities relating to farm lease arrangements should contribute materially to the rate of progress toward a fully mechanized harvest and thereby greatly reduce the present volume of hand labor required in the harvest.

Another farming area that employs substantial numbers of non-local farm workers, the Eastern Shore of Maryland, was the scene of the fifth BAE study made in the South under the defense manpower program. Lying along the route of the annual Atlantic Coast migration, the Eastern Shore produces a score of truck crops that have heavy seasonal requirements for harvest labor, especially between June 20 and August 20. This study revealed three of the principal obstacles to improved labor utilization in truck crop production in this area. These relate to the growth and maturity characteristics of certain truck crops, to the requirements of the market for others, and to the existing pattern of farm operating scale.[7]

Highly perishable crops that mature rapidly often mean a short work day or a short harvest season—or both. This complicates the problem of the operator in attracting and keeping an adequate labor force through-

[7] A preliminary report from this study, entitled *Labor Use in the Eastern Shore Truck Crop Harvest*, will be published shortly by the cooperating agency, the Maryland Agricultural Experiment Station, University of Maryland.

out the harvest. It has unquestionably influenced the decline in acreage on the Eastern Shore of such crops as strawberries which require relatively few work days of short duration in the harvest. Asparagus usually involves a short work day, but it must be cut regularly each day from the beginning of the season, or it will go to seed. Such crops as Irish potatoes, on the other hand, permit of more flexibility in the timing of the harvest operation and have greater appeal to the worker who is thinking more in terms of daily or seasonal earnings than of wage rates.

Planning for steady employment of the labor force may be hindered in several ways by market conditions. An early crop of cucumbers or cantaloupes, for example, often brings a premium on the market and the operator plants with this objective rather than the labor problem in mind. Some plants such as tomatoes and sweet peppers bear until frost, and early planting is necessary in order to obtain high production. Finally, contract dates with freezers and canners must be met, regardless of the interest of farm employers and workers in a more regular pattern of employment.

Size of farm often prevents a leveling of extreme fluctuation in labor demand through such techniques as staggered plantings or diversification of crops having different maturity dates. About a fourth of the farmers interviewed on the Eastern Shore said they had tried to plan their operations in this way. On small farms, however, only 10 percent of the operators had done such planning, as compared with 33 percent on medium-sized farms and 54 percent on large farms.[8]

The impracticability of adjusting their operations penalized small farmers in other ways as well. In most crops small-farm operators paid higher wage rates than larger operators who could offer the worker better earnings at a given wage rate because of longer average work days, a longer total season, and the opportunity to work in more than one crop on the same farm. Small operators were also at a disadvantage in recruiting workers, particularly the migrants who frequently travel in large crews and seek out the larger operations. Systematic methods of recruitment were generally less important than informal negotiations between workers and employers, but where they were used it was most often by the operators of large farms. In recruiting labor, large operators used labor camp associations more than twice as often as small operators and used the facilities of the Employment Service 7 times as often. The frequency of pre-season arrangements for labor was nearly twice as high for large operators as for small operators.

---

[8] Small farms were defined as those having 20 acres or less in truck crops, medium-sized farms as those with 20 to 79 acres in truck crops, and large farms as those with 80 or more acres in truck crops.

Summary

The highlights of the agricultural manpower situation in the South as presented in this paper may be summarized as follows:

1. During the last dozen years the total number of farms, size of farm population and level of farm employment in the South have declined at unprecedented rates.
2. Reductions in the farm labor force of the South are in large part associated with continued high-level employment in industry, on the one hand, and with large-scale increases in labor-saving farm machinery on the other.
3. Farm wage rates in the South increased four-fold between 1940 and 1952, but the differential in rates between the South and the non-south actually widened in terms of cents paid per hour.
4. Despite the recent upward trend in mechanical harvesting, the hired labor input has continued to vary with the acreage and production of cotton in the major cotton-producing States. Continued progress in mechanization, of course, is certain to alter this relationship.
5. Local intensive studies show that:
   a. Despite heavy seasonal demands for farm labor in cotton-producing areas, out-of-season unemployment is still fairly common in some parts of the South.
   b. The heavy out-migration of recent years has not entirely relieved the population pressure on the land in some areas of the South.
   c. While dependent upon many factors, including general economic conditions, continuation of relatively heavy out-migration from some areas of the South appears likely. If it continues, the present training facilities for nonfarm employment are inadequate, and the present dependency burden resulting from selectivity in the migration will be intensified.
   d. Improved information services to farmers and workers are needed as an aid to better utilization of the existing farm manpower force.
   e. If a fully mechanized cotton harvest may be viewed as a desirable goal in the South, attention should be devoted to the solution of such institutional problems as landlord-tenant relations as well as to the technical aspects of machine harvesting.
   f. Truck crop production presents at least three obstacles to improved labor utilization: the growth and maturity characteristics of certain crops, requirements of the market, and the limitations of small-farm operations. Of the three, the diseconomies of less-than-optimum scale probably are most costly to farmer and worker alike.

A METHOD OF SHOWING FARMERS HOW TO ESTIMATE GROSS INCOME AND MARGINAL VALUE PRODUCTS

LOUIS S. DRAKE*
Michigan College of Mining and Technology

FARM accountants and business analysts have developed and made wide use of a set of measures of efficiency of farm management. These include productive man-work-units per man, crop-yield and livestock production indexes, size of business, turnover of capital, *etc.* These measures differ, in approach to problems of business analysis, from the central principle of profit maximization as set out by formal economic theory. The latter holds that output (gross income) is a function of the factors of production, and that the net income reaches its highest value when all factors are employed together in such a way that the marginal return from each factor is equal to its marginal cost. In order that the second idea can serve as a practical supplement to the most widely used methods of farm business analysis, it is necessary that methods be developed for estimating gross income from inputs, and that the estimates be expressed in terms which can be generally understood.

In recent years work has been done on ways in which the gross income of a farm can be estimated from the inputs; *i.e.*, all the elements of the business are integrated so that a total pattern results.[1] If gross income estimating equations can be given credence and can be easily interpreted, then they can aid farmers in estimating the following items of practical interest: (1) how the gross income of a farm compares with the gross incomes of other farms when investments and expenses are considered (estimate of gross income), and (2) what increase in gross income can, on

* This paper is based on the writer's dissertation for the doctorate, "Problems and Results in the Use of Farm Account Records to Derive Cobb-Douglas Value-Productivity Functions," Michigan State College, 1952, (unpublished). The writer is indebted particularly to Professors L. H. Brown, Glenn L. Johnson, E. E. Peterson, Victor E. Smith, Leo Katz, and L. W. Witt for their counsel in carrying through the work.

[1] See Earl O. Heady, "Production Functions from a Random Sample of Farms," *This Journal*, Vol. 28 (Nov., 1946), pp. 989-1004, Gerhard Tintner and O. H. Brownlee, "Production Functions Derived from Farm Account Records," *This Journal*, Vol. 26 (Aug., 1944), pp. 566-71, and Gerhard Tintner, "A Note on the Derivation of Production Functions from Farm Records," *Econometrica*, Vol. 12 (Jan., 1944), pp. 26-34. In these sources value productivity functions are derived statistically from accounts of individual farms. Paul H. Douglas and associates used the idea of a statistical production function on an industry-wide basis, using data for different years as observations in a number of studies. See *The American Economic Review*, Vol. 18, supplement (1928) pp. 139-65, *The Journal of Political Economy*, Vol. 30 (Aug., 1942) pp. 595-602, and Vol. 51 (Feb., 1943), pp. 61-65, and the *Quarterly Journal of Economics*, Vol. 54 (1940), pp. 399-428, and Vol. 52 (1937-38), pp. 1-36 and 215-254.

TABLE 1. TEN GROSS INCOME ESTIMATING EQUATIONS FOR 86 DAIRY FARMS
Type-of-Farming Areas 5 and 6, Michigan, 1950

		Equations									
		1	2	3	4	5	6	7	8	9	10
Constant term		2.871	2.729	2.642	2.512	3.396	1.409	2.307	3.327	1.315	1.242
Category of inputs		Exponents									
Feed expense		0.541		0.432	0.387	0.138		0.383	0.140	0.273	0.271
Crop expense						0.403	0.351		0.370		
Net decrease, machinery		0.451	0.480			−0.017			−0.069		
Total labor charge				0.145	0.130	0.100		0.125	0.088	0.090	0.086
Investment in land			0.082		0.088		0.050	0.031	0.108	0.061	0.020
Investment in improvements								0.088			0.062
Machinery and equipment investment		0.322		0.322		0.367	0.172			0.181	0.180
Productive livestock investment			0.328		0.328		0.150	0.322	0.356	0.154	0.153
Feed and crop investment							0.312			0.307	0.303
Sum of exponents		0.863	0.890	0.899	0.933	0.991	1.035	0.949	0.993	1.066	1.075
5% fiducial limits, ratio of gross income to estimate	Lower limit	0.60	0.61	0.60	0.62						
	Upper limit	1.66	1.65	1.66	1.62	—	—	—	—	—	—

An example will show how the equations are read: From equation 1,
gross income $= 2.871 \times (\text{total farm expense})^{0.541} \times (\text{total investment})^{0.322}$

an average, be expected if any single class of input is increased by a specified amount (estimate of marginal value product).

This article shows how gross income estimating equations can be presented to farmers. The statistical methods used are explained in other articles.[2] In principle, the gross income of a farm is estimated from a single value-productivity equation of the Cobb-Douglas type. Several such equations were derived from account records of 194 Michigan farms in type-of-farming areas 5 and 6, for the year 1950 (Tables 1 to 3). The areas are designated as "dairy and general farming" and "dairy and cash crops" by the Department of Agricultural Economics of Michigan State College. The equations discussed in this paper were obtained from 108 farms receiving less than 60 percent of the gross income from dairy cattle and dairy products. Equations calculated for 86 dairy farms behave in a manner comparable to the equations discussed in this paper, with about equal reliability. Specifically, gross income $= Cx^a y^b \ldots z^k$. The variables $x, y, \ldots z$ are dollar values of categories of productive inputs; $C, a, b, \ldots k$ are estimated parameters.

Estimate of Gross Income

In Figure 1 the gross income of a farm is estimated from total farm expense and total investment by equation 1, Table 2. Unless otherwise specified, total farm expense includes charges for labor, including the operator's, and all other charges except interest on the investment.

Suppose that all charges against a certain farm business amount to $10,000, of which $9,000 is total farm expense and $1,000 is interest on an investment of $20,000. Reading up from $20,000 and across from $9,000, the gross income of this farm is estimated at $11,200 (*A*, Figure 1). The value of the Cobb-Douglas function does not rest on the reliability of the estimate of the gross income of a particular farm. At the 5 per cent confidence level, the gross income of farm *A* can be expected to lie between $7,350 and $17,300 (Table 2). The estimate does provide a starting point for explanations of differences between expected and actual gross income. The gross income of the past year for any farm can be evaluated as being typical, *i.e.*, near the estimate, or at certain achievement levels above or below the estimate. Similarly, anticipated gross incomes from budgeted outlays for a coming year can be interpreted as being at certain planned achievement levels above or below "average," considering classes of inputs, on the basis of past experience of many farms.

Variations in net returns above all charges can be statistically accounted for, in part, by proportions of the classes of factors. Consider farms *A* and *B* on Figure 1. The gross income for farm *B* for an outlay of $10,000

[2] Heady, Brownlee, and Tinter, *op. cit.*

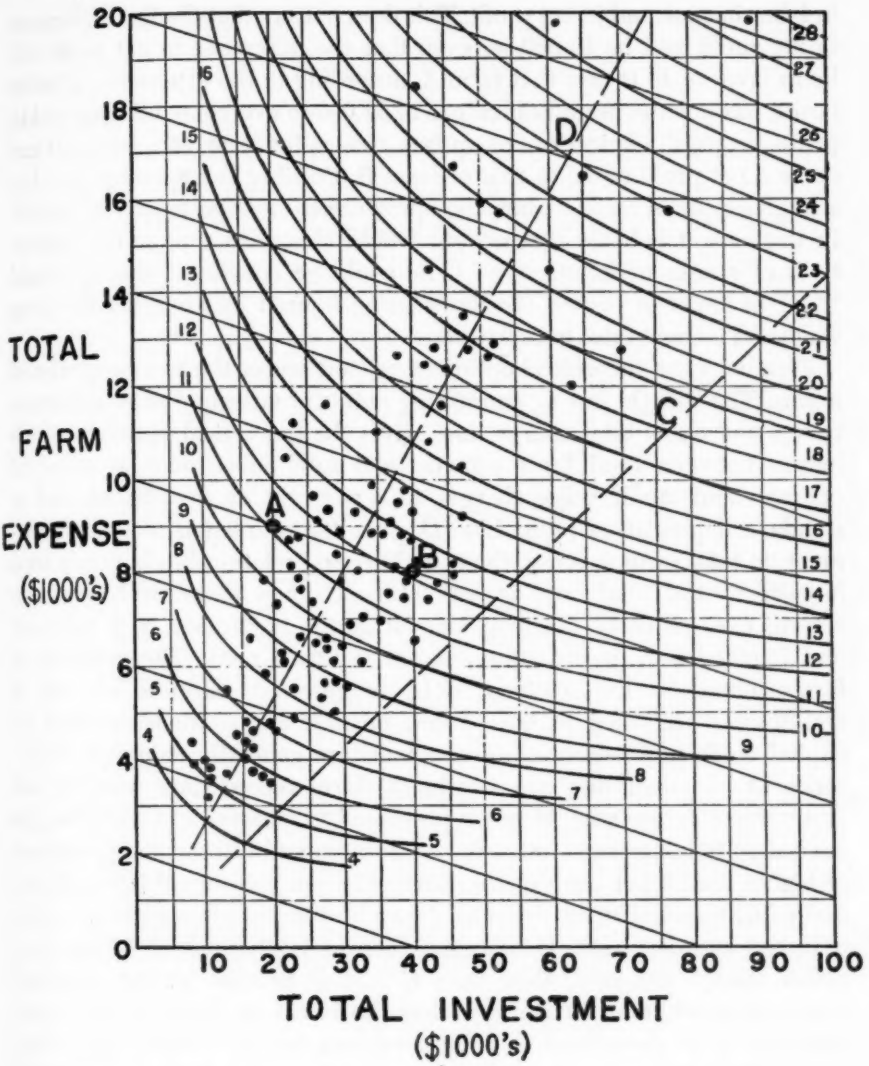

FIGURE 1. GROSS INCOME ESTIMATED FROM TOTAL FARM EXPENSE AND TOTAL INVESTMENT
108 Farms, Type-of-Farming Areas 5 and 6
Michigan, 1950

Straight diagonal lines: equal total cost, total farm expense plus interest on the investment at 5 percent. Read total cost from left-hand vertical scale.
Curved lines: estimated gross income.
Dots: positions of farms.

is estimated to be $12,200, or $1,000 more than for farm A. As the total charges are equal, the difference in gross income amounts to a difference

in labor income and in net profit. This does not say that the final difference in net profit will be $1,000, or even that the difference in net profit will be in favor of *B*. It says that farm *A*, according to the experience of other farms, has a net expected difference of $1,000 to overcome *via* crop yields, prices received, choices of enterprises, size of business, *etc.*, before it can make a net profit equal to that of farm *B*. Possibly the operator of *A* has a large supply of family labor, the operator of *B* a large supply of capital. In this case it is likely that neither would choose to change the proportions of classes of inputs, even if he could be convinced that it should "pay" in terms of profits, the latter being figured by applying the same wage and interest rates to both farms.

Figure 1 gives theoretical optimum proportions of the two categories of inputs. The straight line *C*, connecting points of tangency of gross income curves and equal total charge lines, gives the theoretical optimum distribution between total farm expense and total investment at standard operator and family wage charges, at 5 per cent on investment, and at standard depreciation rates. Line *D* gives the regression of total investment on total farm expense, the actual general relationship between total investment and total farm expense. Line *C* gives theoretical maximum returns over all costs, charging interest on the investment at 5 per cent, and family labor, depreciation, *etc.*, at standard rates. The positions of farms, given by the scattered dots, suggest that farmers are not in equilibrium according to these rates. Possible explanations are that (1) capital tends to be short; (2) investments are generally valued in inventories at less than they are worth; (3) farm record data used do not accurately measure what they are presumed to measure in Cobb-Douglas analysis; (4) farmers subjectively charge marginal interest on investment at higher than 5 per cent; or (5) charge the non-investment items at generally less than dollar for dollar as shown by the records, *e.g.*, labor at *less* than the assumed rate. If marginal interest is charged at 10 per cent rather than 5 per cent, then lines *C* and *D* become almost identical. Charging interest at 10 per cent has the effect of rotating the equal-total-cost lines downward, holding positions on the vertical axis fixed. Thus with a *10* per cent interest charge on investment, the farms would turn out to be scattered along a line formed by the tangency points of gross income curves with *revised* equal total charge lines. A similar chart for 86 dairy farms showed essentially the same result. If the historical data as reported in the farm account books can be taken as substantially accurate, then a 10 per cent interest charge, at the margin, on investment, is more consistent with business behavior of the farmers included in this study than is a 5 per cent charge.

Gross income estimating charts should be of interest to farmers, credit

TABLE 2. SIX GROSS INCOME ESTIMATING EQUATIONS FOR 108 FARMS OTHER THAN SPECIALIZED DAIRY*
Type-of-Farming Areas 5 and 6, Michigan, 1950

		Equations					
		1	2	3	4	5	6
Constant term		1.726	1.514	1.982	1.690	1.545	2.239
Category of inputs		Exponents					
Total farm expense, not labor		0.696	0.622	0.577	0.497	0.482	0.582
Total labor charge				0.159	0.160	0.150	0.164
Investment in land		0.247	0.002	0.239	−0.004	0.039	0.018
Investment in improvements						−0.006	
Machinery and equipment investment			0.350		0.351	0.346	0.184
Productive livestock investment							0.064
Feed and crop investment							−0.003
Sum of exponents		0.943	0.974	0.975	1.004	1.011	1.009
5% fiducial limits, ratio of gross income to estimate	Lower limit	0.65	0.68	0.68	—	—	—
	Upper limit	1.53	1.49	1.49	—	—	—

As an example, equation 1 is read:
gross income = $1.726 \times (\text{total farm expense})^{0.696} \times (\text{total investment})^{0.247}$

* Less than 60 percent of gross income from dairy products and dairy cattle.

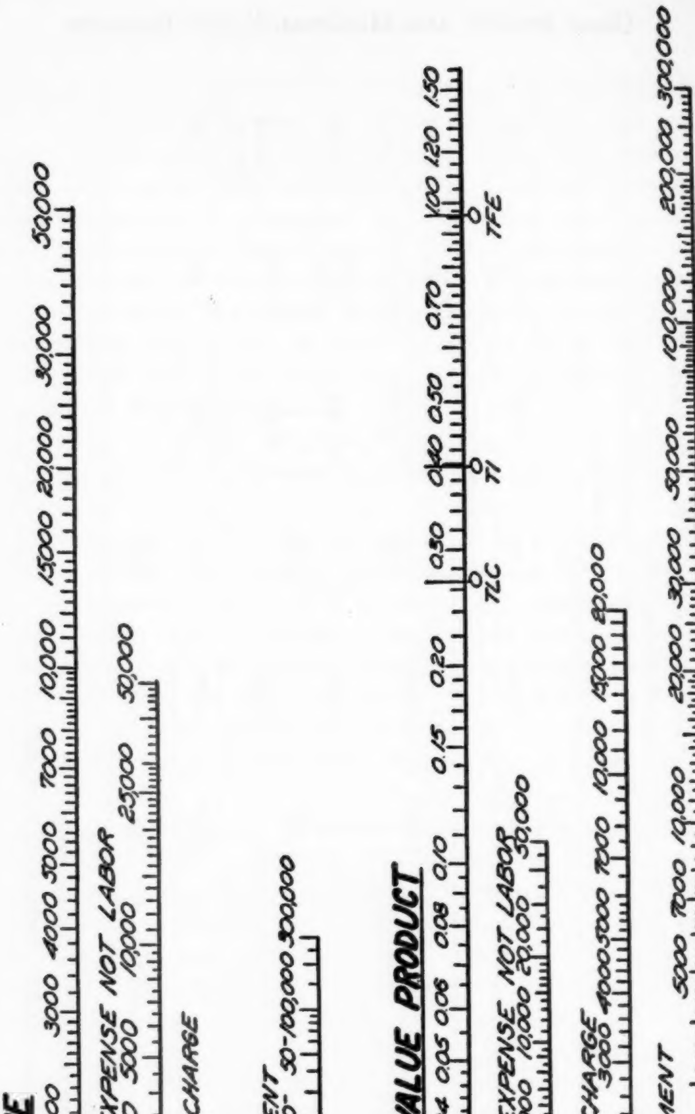

FIGURE 2. CHART FOR ESTIMATING GROSS INCOME AND MARGINAL VALUE PRODUCTIVITIES OF CATEGORIES OF FACTORS ON INDIVIDUAL FARMS
108 Farms, Type-of-Farming Areas 5 and 6
Michigan, 1950

agencies, farm management services, and students of farm management in high schools and colleges. Once the equation of gross income is given, a working understanding of high school algebra is sufficient mathematical background for the construction of a gross income chart such as is shown in Figure 1.

Estimates of Gross Income and Marginal Value Productivities of Classes of Inputs

The use of a gross income estimating function can be extended to any number of classes of inputs. As before, it is not necessary that those interested either learn or brush up on algebra and geometry. As an example, consider equation 3, Table 2.

Figure 2 gives estimates of gross income and the marginal value productivities of categories of inputs for any farm. An example will show how gross income is estimated. Consider a farm with total farm expense not including labor of $10,000, a total labor charge of $5,000, and a total investment of $50,000. Add the sum of the linear distances on the factor category scales to the point marked *O* on the *Gross Income* scale. This can be done by checking distances for values of categories of factors on the edge of a sheet of paper. Adding the total distance to *O* on the gross income scale, gross income for this farm is given at slightly less than $21,000. This estimate of gross income does not call for interpretation of graphs, and the scales (as above) will handle the estimate for any farm in the group.[3]

[3] To show how the scales (Figure 2) are constructed, it is convenient to consider the example in the text. Let P = *gross income;* x = *total farm expense not labor;* y = *total labor charge;* z = *total investment,* and c = the constant term (1.982 in the text). Then $\log P = \log c + 0.577 \log x + 0.159 \log y + 0.239 \log z$. The P-scale is calibrated to include the log of the highest value of gross income likely to occur. Since no gross incomes were less than $1,000, the P-scale begins at $1,000. The log scale itself is stretched out as far as practicable, to make full use of the drawing paper. In the making of Figure 2 the log-cycle was 10 inches long. The values of x, y, and z for all observations in this study were larger than $1,000. Thus all of the factor-scales begin at $1,000. Each factor-scale has a ratio to the P-scale equal to the exponent of the factor.

The remaining problem is to fix the origin, O. This is done by subtracting the distance not shown on the P-scale from the sum of the distances not shown appropriate to the c, x-, y-, and z-scales, according to the above equation. It is clear, since the length of the log-cycle on the P-scale is 10 inches, and the log of 1,000 is 3, that the distance not shown on this scale is 30 inches. This is subtracted from $\log c = 0.297$, plus $(0.577 + 0.159 + 0.239)$ times $\log 1{,}000$, minus 2.925, a net sum of 3.222. This (3.222) times 10 inches = 32.22 inches. Therefore, the adapted origin (O) is $32.22 - 30.00 = 2.22$ inches to the right of the marker for $1,000 on the P-scale. The values of the logs on all scales are replaced with the numbers to which the logs apply. The construction of scales can be simplified by folding diagonally a sheet of standard two-cycle log paper. This procedure is outlined in Croxton and Cowden, *Practical Business Statistics,* Prentice-Hall, 1948, pp. 114-117.

The individual farmer with a given level of charges, expense, investment, and labor, may be interested in comparing his gross income with the estimated gross income of a *typical* farm with the same total charges, *i.e.*, size of business. Coefficients can be computed to give relationships between proportions of categories of inputs and all charges. With these proportions given and the total of charges given, gross income can then be estimated for the typical farm of any particular size. Difference in size of business (at least as measured by total charges) thus accounted for, the difference between the typical gross income and the actual gross income can be analyzed according to other causes. Part of this difference will arise from the proportions in which the categories of inputs are combined, as explained in the discussion of Figure 1.

For a farm with a given organization, the additional or marginal returns can be estimated from additional or marginal outlays in any one of the classes of inputs. The gross income estimating equation provides a way of showing how gross income responds to additional dollars laid out in any one class of factors, other classes being held constant.

Thus, estimates of marginal value productivities of categories of inputs are made from Figure 2 in the following way: Consider first the group of inputs called total farm expense not including labor. Treat the linear distance on the *total farm expense not labor* scale under the *Marginal Value Product* section of Figure 2 as minus, and the linear distances of the total labor charge and the total investment scales under *Gross Income* section of Figure 2 as plus. The values, considering the same farm as in the preceding example, are \$10,000, \$5,000, and \$50,000, respectively. Find the sum of the plus and minus lengths on the respective scales, paying attention to sign. Then add the result to the point marked $\frac{O}{TFE}$ on the *Marginal Value Product* scale (or subtract, if the sum is minus). Since the sum of the plus distances is greater than the minus distance in this case, the result is added. The estimate of the marginal value product with respect to total farm expense not labor is \$1.18. The process is repeated for the other two categories, in each case considering the class of inputs for which it is desired to estimate the marginal value product as minus on the appropriate scale in the marginal value product group. The other two classes of inputs are taken as plus in the gross income group. The

---

The marginal value product scales are prepared similarly. A somewhat complicating feature is that the marginal value product with respect to a factor, x, for example, is given by the Cobb-Douglas function as

$$\frac{\partial p}{\partial x} = \frac{\partial (1.982 x^{0.577} y^{0.189} z^{0.289})}{\partial x} = (0.577)(1.982) x^{(0.577-1)} y^{0.189} z^{0.289}$$

This is converted into log form and the origin for estimating the various marginal value products determined in the same manner as for the estimate of gross income.

marginal value product with respect to labor is estimated at $0.67; the corresponding figure for total investment is $0.0975.

As in the case of gross income, a statistician could work out factors to enable farmers to make comparisons of estimated marginal value productivities on their own farms with averages of farms. Variable log scales could be printed to be used by Smith-Hughes teachers and others in constructing nomographs as in Figure 2. The statistical analyst could prepare sets of instructions for using gross income and marginal value productivity equations, and take part in training courses for teachers. Nomographs similar to Figure 2 could be printed and distributed to people and organizations interested in farm management and farm finance.

Scale vs. Firm

The emphasis of this paper has been on simplified presentation of Cobb-Douglas value productivity analysis. Assuming ways of making general use of Cobb-Douglas equations, a few remarks are in order concerning their relevance and trustworthiness in showing what they are presumed to show.[4] Equations of this type give unbiased estimates of the logarithm of the gross income of a farm. It follows from this fact that the easy estimation of gross income as shown by Figure 2 is possible. The over-all comparative reliability of the estimate is greater than can be obtained from any simple linear method. The standard deviation of the estimate, and hence any upper and lower confidence limits, are proportions of the estimate itself. Therefore the range of the estimate varies as the range of actual gross income values changes, as attention is shifted from one part of a size-of-business scale to another.

Although the Cobb-Douglas estimate of gross income is unbiased, it has been contended that the same cannot be said for the estimate of marginal value productivity. It follows from one theory of the Cobb-Douglas function that estimates of marginal value productivities can not be taken from the function, unless relationships between factors of production and gross income *between* farms also hold *within* farms.[5] According to this theory,

[4] See Earl O. Heady, "Use and Estimation of Input-Output Relationships or Productivity Coefficients," *This Journal*, Vol. 24, No. 5 (Proceedings) 1952, pp. 775-86, and William O. Jones, "The New Agricultural Economics," *This Journal*, Vol. 24, No. 4 (Nov., 1952), pp. 441-450.

[5] Martin Bronfenbrenner, "Production Functions: Cobb-Douglas, Interfirm, Intrafirm," *Econometrica*, Vol. 12 (Jan., 1944), pp. 39-42, and M. W. Reder, "An Alternative Interpretation of the Cobb-Douglas Function," *Econometrica*, Vol. 11 (July-Oct.), 1943, pp. 259-64. Production functions derived by multiple regression, *i.e.*, Cobb-Douglas, and the functions derived from farm account records by multiple regression have the further difficulty that the assumed causal variables, the categories of inputs, are not independent of one another. For a discussion of this see Horst Mendershausen, "On the Significance of Professor Douglas' Production Function," *Econometrica*, Vol. 6 (1938), pp. 143-47.

so-called estimates of marginal value productivities as obtained by the function after the method of Brownlee and Tintner can be expected to be biased upward.[6] However, marginal value productivities estimated by this method in the study of Michigan farms did not turn out to be higher than one would expect on a basis of ordinary common sense.[7] Mere reasonable results do not prove a method, but neither do they support a theory of upward bias.

The objection implied above (that relationships holding between farms do not necessarily hold within farms) could be made to most of the past and present statistical research in farm management where such work has sought, by analysis of groups of farm accounts, principles of management applicable to an individual business. In general, concerning the value of studies of interfarm relationships, the usual consensus is that, in spite of theoretical shortcomings, interfarm results are often helpful in understanding intrafarm processes.

Equations estimating gross income from categories of factors need not be derived only from masses of statistics for many farms. Functions obtained from regression analysis of farm accounts could be complemented and supported or discredited by equations from experimental budgets. Different combinations of planned and expected outlays and incomes for a typical farm could be treated in the same manner as individual farm accounts are treated in the conventional Cobb-Douglas analysis. These simulated observations could be used to develop equations of gross income from factors. This procedure offers a possible answer to the interfarm-intrafarm problem if such a solution is considered necessary.

Statistical stability of the coefficients of gross income equations can be increased, as work progresses from one year to another, by inclusion of more farms in the analysis, provided proper allowance can be made for reverse effects of gross income on outlays. The Cobb-Douglas function assumes that gross income is a function of the factors of production and that there are no important effects in the opposite direction. Data for different years could be combined by reduction of prices of factors and products to normal values.[8]

The immediate practical value of this kind of work depends upon whether people who operate farms can use the results in making decisions. It is reasonable to believe that any farmer who is willing to keep books or to cooperate in a management survey should be interested enough to estimate gross income and marginal value productivities from

[6] Earl O. Heady, O. H. Brownlee and Gerhard Tintner, *op. cit.*

[7] The writer's doctoral dissertation, *op. cit.*, pp. 63-66, 99-103.

[8] Prices of farm products were reduced to normal values in this study with the thought that the procedure might increase the correlation between inputs and gross income. No such effect was achieved. See the writer's dissertation, *op. cit.*, pp. 30-32.

TABLE 3. THREE GROSS INCOME ESTIMATING EQUATIONS FOR 194 FARMS
Type-of-Farming Areas 5 and 6, Michigan, 1950

	Equations		
	1	2	3
Constant term	2.296	1.742	2.286
Category of inputs	Exponents		
Total farm expense, not labor	0.544	0.449	0.544
Total labor charge	0.149	0.157	0.124
Investment in land	0.256	0.101	0.070
Investment in improvements			0.001
Machinery and equipment investment		0.281	0.117
Productive livestock investment			0.040
Feed and crop investment			0.106
Sum of exponents	0.949	0.988	1.002

For example, equation 1 is read
gross income $= 2.296 \times$ (total farm expense, not labor)$^{0.544}$
$\times$ (total labor charge)$^{0.149} \times$ (total investment)$^{0.256}$

expenses and investments. Because of the ease with which comparisons between expected and actual values can be made, and because the comparisons take automatic account of classes of inputs entering into production, functions of the Cobb-Douglas type may have an important place in farm management research, extension work, and education.

THE SELECTION OF LIVESTOCK ENTERPRISES BY ACTIVITY ANALYSIS

EARL R. SWANSON AND KIRK FOX
University of Illinois

THE following application of the recently developed technique of activity analysis to the selection of livestock enterprises to fit a given cropping system is a generalization of the well-established and useful technique of formalized planning known as "budgeting." In brief, the purpose of budgeting is to refine the profit expectations of each of several alternative farm plans, thus facilitating the choice of a plan for the relevant future period. Each alternative plan budgeted includes both: (1) the types of farm enterprises and (2) the quantities of each product to be produced from each enterprise. Conventional farm budgeting consists of choosing from among an infinite number of possible plans those few that are believed to merit consideration. The computation of input requirements, costs, physical production, and returns for each plan is usually of such magnitude to preclude practical consideration of a large number of proposed farm plans for a particular farm. The basis of the necessary narrowing of alternatives is largely the judgment of the worker. Thus there is no assurance that there does not exist a plan among those discarded prior to calculation of anticipated profits that would yield higher anticipated profits than the plan selected.

Activity analysis provides a more powerful technique by increasing the range of alternative plans that might practically be considered. In selecting a plan, consideration is given to combinations of certain enterprises; the varying quantities of product produced from each enterprise in the several combinations differentiate the different "plans." Conventional budgeting can practically consider only a *few* of these alternatives; activity analysis yields immediately the profit-maximizing solution considering *all* possible combinations of different levels of the enterprises considered. The optimal solutions from activity analysis are based on essentially the same assumptions (fixed technical coefficients and certain or single-valued expectations of prices and technical relations) as budgeting, and the latter method could yield the same results given an astronomical number of calculations or some lucky first guesses.

The farm situation. In the following development of the conditions assumed to be especially relevant in the selection of a livestock plan, it is believed that sufficient realism has been injected to suggest a wide variety of farm planning problems that might utilize the activity analysis technique to advantage. The specific farm situation chosen to illustrate the technique is a 320-acre central Illinois farm with a total labor supply

of two men for the entire year. The cropping system selected is assumed to consist of an annual 160 acres of corn, 80 acres of oats, and 80 acres of an alfalfa-brome grass mixture.[1] The basic problem that we attack is the selection of a livestock plan (consisting of one or several enterprises) that will most profitably (given the farmer's price and technical expectations) utilize the available resources. Although many more types of livestock enterprises might be considered, the analysis below is limited to only five which are common to the corn belt: the spring litter hog enterprise, x_1; the fall litter hog enterprise, x_2; the full-feed drylot feeder cattle enterprise, x_3; the full-feed pasture feeder cattle enterprise, x_4; and the delayed-feeding feeder cattle enterprise, x_5. (The quantities x_1 and x_2 represent numbers of litters for each hog enterprise, and the quantities x_3, x_4, and x_5 indicate numbers of cattle fed under each cattle enterprise.)

Expected gross and net income. The expected gross income from all these enterprises may be represented by the formula

$$I^* = \sum_{i=1}^{5} p_i x_i$$

where the p_i are the expected unit prices of the products of each of the five livestock enterprises. The production costs to be considered explicitly are those occasioned by the use of corn, x_6; protein feed, x_7; and the purchase of feeder calves, x_8. (The quantity x_6 is measured in bushels, x_7 in pounds, and x_8 in number of animals.) Thus we may write an expected net income realtionship by subtracting from the expected gross income I^* the costs of these three inputs:

$$I = I^* - \sum_{i=6}^{8} p_i x_i$$

where the p_i are the expected unit costs of the three purchased inputs. The omission of certain inputs should be noted. Labor and roughage are integrated into the analysis in the following sections. However, the costs of certain other inputs (housing, equipment, etc.) are entirely omitted from the analysis. These costs comprise a relatively small percentage of the total cost of producing the livestock considered. In hog production, feed and labor comprise approximately 80 percent of total cost; and in beef cattle feeding, feed and labor represent about 77 percent of the total cost.[2] Further, most of the costs not entering the net income equation are

[1] For a discussion of the use of activity analysis in selecting a crop rotation, see C. Hildreth and S. Reiter "On the Choice of a Crop Rotation Plan," in Tjalling C. Koopmans, ed., *Activity Analysis of Production and Allocation*, Cowles Commission Monograph No. 13, Chapter XI, New York, Wiley, 1951.

[2] R. H. Wilcox and R. A. Hinton, *Detailed Cost Report for Central Illinois, 1951*, AE2907, Department of Agricultural Economics, University of Illinois, November 1952.

fixed in the short run in the sense that they are not functions of the enterprise size.

By introducing expected prices[3] into the net income equation, we may tentatively summarize the problem at this juncture as the determination of quantities of x_i which will maximize the net income equation

(1) $I = \$305x_1 + \$280x_2 + \$370x_3 + \$355x_4 + \$355x_5 - \$1.48x_6 - \$0.04x_7 - \$130x_8$

subject to the available resources and the technical relations of production.

Labor available. Much of the impetus for livestock enterprises on corn-belt farms is derived from the seasonal distribution of labor required for

TABLE 1. LABOR REQUIREMENTS AND SURPLUS LABOR AVAILABLE FOR LIVESTOCK WITH CROPPING SYSTEM OF CORN, CORN, OATS, ALFALFA-BROME ON A 320-ACRE CENTRAL ILLINOIS FARM WITH A TWO-MAN LABOR SUPPLY[a]

Period	Crop labor requirements[b]	Labor available for livestock	Total
January 15–February 14	60	420	480
February 15–March 14	65	415	480
March 15–April 14	125	355	480
April 15–May 14	135	345	480
May 15–June 14	320	160	480
June 15–July 14	385	95	480
July 15–August 14	100	380	480
August 15–September 14	85	395	480
September 15–October 14	210	270	480
October 15–November 14	250	230	480
November 15–December 14	170	310	480
December 15–January 14	60	420	480

[a] Based on detailed cost project data, Department of Agricultural Economics, University of Illinois.

[b] Exclusive of labor for haymaking.

crop enterprises. This usually results in a supply of surplus labor during certain months, especially in areas where competent labor must be hired annually and cannot conveniently be obtained on a day basis. Also family labor is frequently reluctant to work at tasks other than those on the home farm. Thus in our scheme we assume that the only labor available for the care and feeding of livestock is the surplus remaining after the crop requirements have been satisfied. Further it is assumed that the opportunity cost of the surplus labor is sufficiently low to be neglected. The fact that

[3] Prices used are averages for the five-year period 1948-52. Sources are *Drovers Journal Yearbook of Statistics* and *Illinois Farm Economics*. Obviously any expected set of prices might be employed. Estimated pigs marketed per litter: enterprise No. 1, 6.3; enterprise No. 2, 6.5. Estimated market weights: hogs, 225 pounds; cattle, 1,050 pounds. Purchase weight of feeder cattle: 400 pounds. Selling prices per 100 pounds: hog enterprise No. 1, \$21.50; enterprise No. 2, \$19.10; cattle enterprise No. 1, \$35.10; enterprises No. 2 and No. 3, \$33.80. Corn: \$1.48 per bushel. Protein supplement: \$0.04 per pound. Feeder cattle purchase price per 100 pounds: \$32.50.

livestock operations are performed on the farm and require no travel to and from off-farm employment lends reasonability to the latter assumption.

For the farm under consideration, the cropping system selected results in the estimated monthly labor requirement distribution shown in Table 1. Considering the total labor supply per period to be 480 hours (240 hours per man per month), the monthly quantities of surplus labor available for livestock production are also set forth in Table 1. Other assumptions concerning labor available could, of course, be employed.

Roughage available. The selection of a rotation to meet certain profit criteria or goals of soil conservation frequently results in a supply of

TABLE 2. NUMBER OF PASTURE DAYS AVAILABLE AND THEIR HAY EQUIVALENT FOR 80 ACRES OF ALFALFA-BROME GRASS[a]

Period	Pasture[b]	Hay equivalent[c]
	(days)	(tons)
April 15–June 14	5,200	104
June 15–August 14	5,200	104
August 15–October 14	3,600	72

[a] *Planning the Farm Business*, College of Agriculture, University of Illinois, Urbana, 1947.
[b] A pasture day is the amount of pasture eaten in one day by a mature horse or cow receiving no other feed.
[c] Pasture may be transformed into hay at an estimated rate of 50 pasture days required to produce one ton of hay.

roughage (hay and/or pasture) for which livestock may provide the only profitable mode of disposition. In addition there appears to be a widespread reluctance on the part of farmers to increase livestock operations beyond the point at which all roughage grown on the farm is consumed. The bulkiness of the product and the attendant inconvenience and cost of handling, effectively restricts the sale and purchase of hay in many instances. Hence it is believed that an assumption of a fixed supply of roughage with zero opportunity cost is consistent with the rationale of many corn-belt farmers and is not damaging to the realism of the analysis. The crop rotation selected in the instant case provides for 80 acres of alfalfa-brome grass mixture which may be utilized either as pasture or hay in the quantities set forth in Table 2.

If utilized as hay, the haymaking process will require labor at the approximate rate of 5.5 hours per ton of hay produced. Haymaking may be performed in any or all of three periods; hence the quantities of hay (tons) produced are designated as x_9, x_{10}, and x_{11} to correspond to the three periods in Table 2.

Restraints. In this section we develop a set of restraining relations by describing in turn the demands made by each activity ($x_1, x_2, x_3, \ldots . x_{11}$) upon each of the variable inputs considered: labor, pasture, corn, protein

feed, feeder calves, and hay. The total annual labor and feed requirements for each of the livestock enterprises are presentd in Table 3. From these data and the labor available for livestock production as indicated in Table 1, we may now write the relations defining the restrictions on the choice of a livestock plan that are imposed by the supply of labor.

TABLE 3. LABOR AND FEED REQUIREMENTS FOR SELECTED LIVESTOCK ENTERPRISES[a] (UNITS PER LITTER FOR HOGS AND PER ANIMAL FOR CATTLE)

System	Labor[b]	Pasture	Hay	Corn	Protein Feed
	(annual hours)	(days)	(tons)	(bushels)	(pounds)
Hog enterprise					
No. 1 (x_1)	29.6	52	0	100	440
No. 2 (x_2)	21.2	0	0.1	114	590
Beef cattle enterprise					
No. 1 (x_3)	15.0	0	0.9	65	280
No. 2 (x_4)	15.1	60	0.8	55	175
No. 3 (x_5)	17.0	120	2.3	35	200

[a] Estimates based on Appendices III and IV, H. C. M. Case and P. E. Johnston, *Principles of Farm Management*, Lippincott, Chicago, 1953. Hog enterprise No. 1 is characterized by having pigs farrowed in the period February 15 to March 15 with marketing approximately six months later at 225 pounds. Hog enterprise No. 2 consists of fall-farrowed pigs (between August 15 and September 15) with marketing at the same age and weight as hog enterprise No. 1. All three beef cattle enterprises begin with the purchase of good to choice beef feeder calves weighing approximately 400 pounds in the period October 15 to November 15. Under beef cattle enterprise No. 1 the calves are full-fed corn in drylot and are fed to a rather high degree of finish for market in the following September. Beef cattle enterprise No. 2 emphasizes a more liberal use of roughage than beef cattle enterprise No. 1. After limited grain feeding during the winter the cattle are full-fed corn on pasture during the summer months and then are marketed in September after approximately 30 days in the drylot. Beef cattle enterprise No. 3 is a "delayed feeding" system under which even more roughage is utilized than in enterprise No. 2. The initial part of the feeding period is similar to that of No. 2; but after the cattle are placed on pasture, no grain is fed for approximately 100 days. The finished cattle are sold in November of the year following purchase. Sale weight of all cattle is considered to be 1,050 pounds.

[b] The seasonal distribution of the total labor requirements for each enterprise is presented in the relations (2) through (13). The labor requirements for livestock are based on data from the detailed cost project, Department of Agricultural Economics, University of Illinois.

Considering first each of the 12 labor periods (Table 1), we have:

(2)	(Jan. 15-Feb. 14)	$1.4x_1 + 1.8x_2 + 1.5x_3 + 1.4x_4 + 1.4x_5$	VII	420
(3)	(Feb. 15-March 14)	$9.8x_1 + 2.4x_2 + 1.4x_3 + 1.4x_4 + 1.4x_5$	VII	415
(4)	(March 15-Apr. 14)	$4.0x_1 + 0.4x_2 + 1.4x_3 + 1.4x_4 + 1.4x_5$	VII	355
(5)	(Apr. 15-May 14)	$2.8x_1 + 0.6x_2 + 1.3x_3 + 1.4x_4 + 1.5x_5$	VII	345
(6)	(May 15-June 14)	$2.2x_1 + 0.4x_2 + 1.3x_3 + 1.5x_4 + 1.2x_5 + 5.5x_9$	VII	160
(7)	(June 15-July 14)	$2.2x_1 + 0.4x_2 + 1.3x_3 + 1.3x_4 + 1.2x_5 + 5.5x_{10}$	VII	95
(8)	(July 15-Aug. 14)	$2.2x_1 + 0.6x_2 + 1.3x_3 + 1.3x_4 + 1.2x_5$	VII	380
(9)	(Aug. 15-Sept. 14)	$2.6x_1 + 5.8x_2 + 1.5x_3 + 1.5x_4 + 1.2x_5 + 5.5x_{11}$	VII	395
(10)	(Sept. 15-Oct. 14)	$0.6x_1 + 4.0x_2 + 1.3x_3$	VII	270
(11)	(Oct. 15-Nov. 15)	$0.6x_1 + 1.2x_2 + 1.3x_3 + 1.3x_4 + 2.6x_5$	VII	230
(12)	(Nov. 15-Dec. 14)	$0.6x_1 + 1.8x_2 + 1.2x_3 + 1.2x_4 + 1.2x_5$	VII	310
(13)	(Dec. 15-Jan. 14)	$0.6x_1 + 1.8x_2 + 1.5x_3 + 1.4x_4 + 1.4x_5$	VII	420

Thus, for example, in the second labor time period—relation (3) above—there are 415 man hours of labor available. Each litter of spring pigs, x_1 requires 9.8 hours during this period, while each animal being fed in beef cattle enterprise No. 3, x_5, requires 1.4 hours during the period. A recognized limitation here is that the labor requirements per litter and per beef animal are not permitted to vary with herd size. Although not used in this study, a refinement in technique to allow such variation is the introduction of additional activities to correspond to herds of various sizes. This, of course, increases the computational burden.

Continuing with the transformation of pasture directly into livestock or into the intermediate input of hay, we may write:

(14) (April 15-June 14) $16x_1 + 12x_4 + 35x_5 + 50x_9 \leqq 5{,}200$
(15) (June 15-August 14) $20x_1 + 36x_4 + 50x_5 + 50x_{10} \leqq 5{,}200$
(16) (August 15-October 14) $16x_1 + 12x_4 + 35x_5 + 50x_{11} \leqq 3{,}600$

Relation (15), for example, indicates that 5,200 pasture days are assumed to be available during the time period June 15 to August 14. For each litter of pigs raised in hog enterprise No. 1, 20 pasture days are required during this period, 36 pasture days for each animal in beef enterprise No. 2, 50 for each animal in beef enterprise No. 3, and 50 pasture days for each ton of hay.

In the remaining restraining relations use is made of the flexible device of intermediate inputs as suggested by Koopmans.[4] Separate activities are added for corn buying, protein feed buying, feeder cattle buying, and haymaking. None of the intermediate inputs supplied by these activities are assumed to be on hand at the beginning of the production period, and none are to remain at the end of the period.

We first define the procurement and use of the intermediate input of corn. The assumption here is that the alternative of directly marketing the corn produced from the cropping system is sufficiently effective as an opportunity cost that the corn is "bought" from the cropping system by the livestock sector of the farm business. The total amount bought may exceed that produced on the farm; the only condition to be satisfied is that the amount procured for the livestock is not in excess of estimated feed requirements. Denoting the corn-buying activity level as x_6 (number of bushels), and obtaining the corn requirements for each livestock system from Table 3, we have:

(17) $100x_1 + 114x_2 + 65x_3 + 55x_4 + 35x_5 - x_6 = 0$

In similar fashion a protein feed buying activity is established and its level designated as x_7 (pounds):

(18) $440x_1 + 590x_2 + 280x_3 + 175x_4 + 200x_5 - x_7 = 0$

[4] Tjalling C. Koopmans, "Analysis of Production as an Efficient Combination of Activities," in Tjalling C. Koopmans, ed., *op. cit.*, Chapter III, page 40 ff.

The feeder cattle for each of the three cattle enterprises are purchased from sources external to the farm. This is in contrast to the hog enterprises in which it is assumed that the replacement of animals in gilt breeding herds is made from the young animals produced. Hence a feeder cattle buying activity, x_8, is necessary to supply each of the three cattle enterprises:

$$(19) \quad x_3 + x_4 + x_5 - x_8 = 0$$

The restriction in (19) is simply that of neither buying more nor less feeder cattle than required for the three cattle enterprises.

Finally, a condition is imposed to insure that only enough hay is produced to satisfy the feed requirements of the livestock. The net amount of hay at the end of the production period is thus required to be zero. We may write this restraint as the total hay consumption of the livestock minus the total hay production in all three periods (x_9, x_{10}, and x_{11}) set equal to zero.

$$(20) \quad 0.1x_3 + 0.9x_3 + 0.8x_4 + 2.3x_5 - x_9 - x_{10} - x_{11} = 0$$

The problem may now be stated succinctly as the maximization of net income (1) subject to the restrictions expressed in the relations (2) through (20). The power of activity analysis is now revealed in its ability to simultaneously consider a large number of restraints of different varieties in the choice of solution that yields in this case a maximum expected net income.

Results. The solution was computed by the simplex method of Dantzig[5] as presented by A. Charnes, et al.[6] The net income maximizing solution requires a plan consisting of three litters of fall pigs, x_2, and 72 feeder cattle to be fed in enterprise No. 2, x_4. A larger number of cattle in relation to hogs than might have been expected reflects in part the relatively greater profitability of cattle during the period upon which prices were based (1948-52) than has generally prevailed historically. Records of the Illinois Farm Bureau Farm Management Service indicate returns per $100 feed fed to feeder cattle during this period were about seven percent above their 20-year average, 1933-52; returns per $100 feed fed to hogs during the same five-year period were about eight percent below the 1933-52 average returns to hogs.

---

[5] G. B. Dantzig, "Maximization of a Linear Function of Variables Subject to Linear Inequalities," in Tjalling C. Koopmans, ed., *op. cit.*, Chapter XXI

[6] A. Charnes, W. W. Cooper, and A. Henderson, *An Introduction to Linear Programming*, New York, Wiley, 1953. Our use of intermediate inputs occasioned the employment of artificial vectors in our starting basis as suggested in pages 15-18 of this reference. The total computational time was approximately 12 days for one clerk with a conventional desk calculator.

As shown in Table 4, the labor supplies in three periods limit the expansion of livestock production. The seasonal pattern of surplus labor available under the optimal solution, as well as the pasture days still remaining, may furnish clues with respect to inclusion of other types of livestock enterprises in a future activity analysis of a similar situation.

TABLE 4. SURPLUS LABOR AND PASTURE AVAILABLE WITH CROPPING SYSTEM OF CORN, CORN, OATS, ALFALFA-BROME ON A 320-ACRE CENTRAL ILLINOIS FARM; LIVESTOCK PLAN OF 72 FEEDER CATTLE (CATTLE ENTERPRISE NO. 2) AND THREE LITTERS OF FALL PIGS (HOG ENTERPRISE NO. 2); TWO-MAN LABOR SUPPLY

Period	Surplus labor available	Pasture available
	(man hours)	(days)
January 15–February 14	313	
February 15–March 14	306	
March 15–April 14	253	
April 15–May 14	242	3,876
May 15–June 14	0	
June 15–July 14	0	2,604
July 15–August 14	284	
August 15–September 14	0	300
September 15–October 14	257	
October 15–November 14	132	
November 15–December 14	218	
December 15–January 14	313	

Estimated net receipts as defined in (1) are also an interesting part of the solution yielded by activity analysis. By substitution in equation (1) we obtain:

$$(1)\quad I = \$305\overset{x_1}{(0)} + \$280\overset{x_2}{(3)} + \$370\overset{x_3}{(0)} + \$355\overset{x_4}{(72)} + \$355\overset{x_5}{(0)} - \$1.48\overset{x_6}{(4{,}302)} - \$0.04\overset{x_7}{(14{,}370)} - \$130\overset{x_8}{(72)} = \$10{,}080$$

The timing of hay production furnished by the analysis is also of interest. Substituting the livestock numbers and hay production furnished by the solution into (20) we have:

$$(20)\quad 0.1\overset{x_2}{(3)} + 0.9\overset{x_3}{(0)} + 0.8\overset{x_4}{(72)} + 2.3\overset{x_5}{(0)} - \overset{x_9}{(9.2)} - \overset{x_{10}}{(0)} - \overset{x_{11}}{(48.7)} = 0$$

Of the total hay production of 57.9 tons, 9.2 tons are to be produced in the first period, x_9, while 48.7 tons are to be produced in the third period, x_{11}. Apparently the heavy labor demands of the oat harvest and corn cultivation during the period for producing the second hay crop (only 95 man hours available for livestock in period June 15-July 14) were of such magnitude to shift hay production to the other two periods.

Concluding remarks. It is hoped that the foregoing activity analysis of a relatively simplified problem in farm planning has made apparent

the power and versatility of the technique.[7] The full fruition of its use in farm planning must, of course, await more refined estimates of production coefficients, a problem outside the scope of this article.

Also, the computational work entailed, although not unduly excessive in the problem presented, may preclude a wider use of the technique. However, a program is being written for the electronic digital computer at the University of Illinois which will reduce the computational time for problems of this nature to a matter of minutes.

[7] For the application of activity analysis to a different type of agricultural problem, see Frederick V. Waugh, "The Minimum-Cost Dairy Feed," *This Journal*, Vol. XXXIII, August 1951, pages 299-310. Since the preparation of the present article, at least two other articles dealing with agricultural applications of activity analysis have appeared: Walter D. Fisher and Leonard W. Schruben, "Linear Programming Applied to Feed-Mixing Under Different Price Conditions," *This Journal*, Vol. XXXV, November 1953, pages 471-483 and Richard A. King, "Some Applications of Activity Analysis in Agricultural Economics," *This Journal*, Vol. XXXV, December 1953, pages 823-833.

COMBATING UNCERTAINTY IN AGRICULTURAL PRODUCTION*

SYDNEY D. STANIFORTH**
University of Wisconsin

THE "riskiness" of agricultural production refers to the farmer's inability to estimate accurately the future income from current resource use. Economic hardship accrues to the farmer when the estimates of future income on which he based his production plans turn out later to have been incorrect. This defines a problem area of anticipation formulation and outlook forecasting. Herein attention has been focussed on the other aspect of "riskiness": What can farmers and policy-makers do to reduce the impact of imperfect knowledge on resource use planning?

When farmers adjust their pattern of resource use as a precaution against the uncertainty of estimated future income a further source of inefficiency is introduced. It has been demonstrated in conceptual analysis[1] that precautions to uncertainty in resource use result in a loss of income to the farmer and of consumable goods to society. Accepting such precautionary adjustments as a source of inefficiency, the problem becomes one of determining how to reduce the uncertainty of planning. Many adjustments in farm organization and policy programs have been recommended to reduce uncertainty. In this study the effectiveness of some of these recommendations have been tested. Among those primarily within the control of the individual farmer, diversification and form of tenure have been examined; among proposed agricultural programs crop insurance has been tested.

Indirect Approach in Analysis

To determine the effectiveness of various methods which have been proposed to reduce uncertainty in farm planning requires objective measurement to detect changes in uncertainty. Because of the number of variables involved and the measurement problems confronted the empirical analysis was necessarily indirect. It has been conducted in terms of variability in net income rather than uncertainty itself.

---

* A major portion of this paper is based on research conducted under project No. 1045 of the Iowa Agricultural Experiment Station which was summarized as a Ph.D. Thesis at Iowa State College by the writer.

** The writer acknowledges the valuable suggestions of E. O. Heady and R. J. Jessen of Iowa State College and R. L. Clodius of the University of Wisconsin.

[1] See, G. S. Stigler, *The Theory of Price;* A. G. Hart, "Anticipations, Uncertainty and Dynamic Planning." Chicago University, *Studies in Business Administration,* 11:1-98, 1940, and E. O. Heady, *Economics of Agricultural Production and Resource Use,* pp. 500-534.

The concept of uncertainty[2] defies direct empirical measurement in absolute terms. The mental experience of indeterminacy known as uncertainty is uniquely formulated by each individual based on his subjective anticipations and his confidence in their accuracy. Precautionary reactions in resource use are the outcome of the individual's uncertainty formulation, his disposition to undertake uncertainty and the rigidities of this planning context. Even in identical planning contexts each individual can experience differing uncertainties and reactions to it. It is common to all individuals, however, that uncertainty of future income is the basic reason for taking precautions in the organization of production.

In formulating anticipations and their associated uncertainty evaluations, historical experience of income variability is probably only one variable in a very complex system.[3] If, however, some action is taken which will change the variability of net income, that action will change the uncertainty evaluations of all individuals in the same direction, even though in varying degrees. The importance of net income variability in formulating uncertainty evaluations is different for every individual so any given reduction in net income variability will have a different degree of effect on uncertainty for each individual but it will have a consistent directional effect of reducing uncertainty for all of them. If, then, any particular action or program reduces net income variability of a particular production pattern it can be concluded that it will reduce uncertainty also.

If any action is effective in reducing uncertainty under any pattern of resource use it will probably result in a change in that pattern of resource organization because the need for precautionary adjustments will also be reduced. This can give an accumulative effect especially if the elimination of precautionary adjustments permits the firm to achieve substantial increases in income. This could even be initiated by psychological factors which affect the nature of the individual's reactions to a given uncertainty situation. This accumulative aspect of reactions to uncertainty is characteristic of the concept itself. It is, however, an accumulation of effect which by its nature cannot reverse the direction of change in uncertainty. It can only accentuate it. This, therefore, is consistent with the present method of detecting changes in uncertainty as only directional changes of increase or decrease are dealt with and no attempt is made to empirically quantify the degree of increase or decrease.

---

[2] Uncertainty is used here to refer to the state of imperfect knowledge in which the probability distributions of anticipations cannot be established by empirical observation. Many situations which constitute a risk, taking all producers as a whole, are classified as uncertainty to individual producers.

[3] It is, of course, assumed here that historical experience of net income variability is included, either directly or indirectly, as a variable in this system. Since the only reason that uncertainty has any economic significance in production planning is that net income is unpredictably variable over time, this assumption can hardly be avoided.

Measures of Variability

In this analysis of uncertainty through income variability it is necessary to have objective measures of income variability. The whole distribution of net incomes is relevent in describing variability but for purposes of recording and testing differences a single parameter (or single-valued function of more than one parameter) offers many advantages in convenience and clarity.

For purposes of comparing variabilities the dispersion of net income observations is of primary importance. An absolute measure of dispersion, however, can give a very misleading impression in the comparison of two distributions. A very narrow absolute dispersion about a very low mean level of income would be indicative of a higher degree of uncertainty than a wider absolute dispersion about a much higher mean level of income. Comparisons of income variability, when used to indicate differences in uncertainty, must involve both the dispersion of the distribution of net incomes and the mean level of net income about which the dispersion is observed.[4] This is even more important if the dispersion is large enough relative to the mean level of income to include the occurrence of some negative net incomes in the distribution. The standard deviation is the estimator which comprehensively describes the dispersion of a distribution of net incomes. The dispersion measured by the standard deviation, however, is related to the mean level of income in a more informative measure by the *coefficient of variation.*[5]

Year to year changes in net income are measured by the mean of the absolute values of the first differences in the chronological series of net incomes. Since extremes of high and low net income do not occur in consecutive years this measure can be expected to indicate a lower variability when expressed as a percentage of the mean level of net income. When so expressed it is referred to as the *relative mean of first differences.*

Sources of Data

Establishing practical and acceptable sources of necessary data for the empirical analysis of the problem set forth is very difficult because of the continuity required. A current cross-sectional sample of agriculture would only give the income variability among farms under a single economic

[4] Evidence in support of this statement was brought out in a comparison of income variability between type-of-farming areas in Iowa. The Southern pasture area is accepted to be the high risk area by any basis of judgment and the Eastern livestock area the most stable income area. Measuring income variability by the absolute dispersion this was reversed. When the absolute dispersions were expressed relative to mean, however, the pattern between type-of-farming areas conformed to the accepted pattern.

[5] The coefficient of variation is the standard deviation expressed as a percentage of the mean.

context rather than the variability over time which is required. The source from which the data have been drawn is budgets representing a reconstruction of income experience from known prices, yields and physical productivity data over a period of thirty-two years, extending from 1917 to 1948.

Applying historical prices, yields[6] and costs to these budgeted farms, a series of net income data were obtained for each such farm. A budget was constructed for each of four different resource organizations or types of farming. The product combination for each of the four budgets was selected to include the four product combinations which occur most frequently in Iowa agriculture.

The four product combinations are:

1. Cash grain, consisting of 240 acres of cropland without any livestock in the combination.
2. Hog-dairy, consisting of 160 acres of cropland with a 14-cow dairy herd and 20 litters of hogs.
3. Hog-beef feeders; consisting of 160 acres of cropland with 25 feeder steers and 20 litters of hogs.
4. General livestock, consisting of 160 acres of cropland with five dairy cows, 10 litters of hogs and 10 feeder steers.

In each case the cropland is all considered to be devoted to the production of grain and feed. The rotation used in the budget is: corn, corn, oats, hay (mixed clover and timothy).

Four synthetic farms, each engaged in producing one of the four product combinations, were located in each township which was selected. The effectiveness of diversification was studied on the basis of fifty townships located throughout Iowa so as to account for differences between areas. Due to the magnitude of the task of recalculating variability in net income under each of the precautionary patterns and program proposals this section of the analysis has been restricted in scope. Six townships which represent problem situations in Iowa were selected for this aspect of the analysis.

Diversification

Diversification of enterprises or products is the commonest precaution to uncertainty recommended for individual farmers. Its chief purpose is to lessen the possible dispersion of incomes by reducing the percentage contribution of any single enterprise to total income. The implication of diversification is that the probability of large losses occurring simultaneously in all enterprises, and so the variability of net income from the whole firm, is greatly reduced. In this role, the effectiveness of diversifi-

[6] Township yield data were used for crops as the township is the smallest unit upon which continuous yield data are available.

cation depends on the relationship between income determination in different enterprises. If income determination is independent between enterprises the probability of any loss occurring simultaneously in all enterprises is reduced to the product of the respective probabilities of that loss occurring in each enterprise. This condition of independence is not fulfilled in agriculture. In order to reduce income variability by diversification enterprises with the lowest correlation of net incomes must be combined.

The effect of diversification on uncertainty has been studied by examining differences in income variability between product combinations.

TABLE 1. COMPARISON OF INCOME VARIABILITY IN FIVE TYPE-OF-FARMING AREAS WITH FOUR DEGREES OF DIVERSIFICATION, FIFTY IOWA TOWNSHIPS, 1917–1948

Measure	Area	Organization			
		Hog-Dairy	Hog-Beef Feeder	General Livestock	Cash Grain
Coefficient of variation	Western livestock	97.5	109.5	98.0	92.8
	Southern pasture	94.6	111.2	98.8	94.2
	Central cash grain	87.8	98.8	87.4	80.1
	Eastern livestock	82.6	90.9	82.5	76.0
	Northeastern dairy	87.3	96.8	86.3	79.2
Relative mean of first differences	Western livestock	54	66	55	53
	Southern pasture	53	69	59	55
	Central cash grain	44	53	43	40
	Eastern livestock	40	48	40	37
	Northeastern dairy	46	55	45	42

Product combinations are compared rather than individual enterprises because the level and variability of net income from the whole farm is of basic importance in determining uncertainty.

Cash grain represents the least diversification as it is completely specialized to crops to be sold in the form they are produced. The hog-beef feeder combination is the first step in diversification. While it adds livestock to the product combination the livestock consists entirely of meat production. The hog-dairy farm is a greater degree of diversification as it adds both meat and milk production to crops. General livestock is the most diversified of the four including all three types of livestock.

Both measures of income variability, in Table 1, follow the same pattern in the comparison of product combinations so there is no need to separate them in interpretation. The hog-beef feeder combination has the highest variability and is estimated to be the highest uncertainty combination. The cash grain combination exhibits the lowest uncertainty due primarily

to the high level of income it produces.[7] Hog-dairy and general livestock exhibit very similar degrees of uncertainty. A slightly lower degree of uncertainty is associated with general livestock.[8] The estimated relative degrees of uncertainty, then, in descending order of degree, are: hog-beef, hog-dairy, general livestock and cash grain. This means that diversification is effective in reducing uncertainty in livestock producton.

The effectiveness of diversification in reducing uncertainty has applicaton in individual farm planning. It influences the choice enterprises in both established farms and beginning farms. Cash grain, having the lowest uncertainty, is a good choice for the major enterprise of beginning farmers. Where it is an essential part of the rotation the addition of some livestock is usually essential to dispose of the hay produced. Beyond this minimum number required to dispose of hay livestock can still play an important role in the expansion or development of the farm. By adding livestock the farmer can effectively increase the size of business with limited capital more readily than by acquiring more land with high land prices and keen competition for rentable land.

In adding livestock to a farm business low uncertainty is not the single criterion of choice but relative degrees of uncertainty between alternative livestock combinations is very important. In the choice of which livestock enterprises to undertake the major point to be considered with respect to uncertainty is that the more diversified combinations are less uncertain than the hog-beef feeder combination. The high uncertainty of beef feeders is due to a relatively small margin which mean that minor changes in prices and costs can have a major effect on income.

Leasing[9] and Part-Equity Ownership

The individual who is deciding how to organize limited resources to establish a farm business can choose between leasing and part-equity

---

[7] Because of the influence of the level of income here this may well be a special case in that Iowa has a very high level of productivity and income in crop production. A corresponding reduction in income would also result if the hay produced in the cash grain rotation cannot be marketed as hay.

[8] An exception to this pattern is noted for the Southern Pasture and Western Livestock areas. The level of income derived from the livestock portion of the hog-dairy combination is higher than from the general livestock. This gives the hog-dairy combination a lower relative income variability in the two areas of low crop productivity. Inasmuch as the hog-dairy combination can be maintained in the low crop productivity areas its higher level of income from livestock will have the effect of reducing uncertainty. The hog-dairy combination can be maintained in these two areas, however, only by considerable feed purchases. Since the continued purchase of hay is not always possible, the size, and so the level of income, of the livestock in the hog-dairy combination would have to be reduced to adapt it to the low productivity areas. If this is done the hog-dairy combination loses what very small advantage it had in these two areas.

[9] In this study the income lost by any inefficiency resulting from the terms or form of the lease itself has not been considered.

ownership as two major alternatives. In terms of business organization the two forms of tenure can be compared with respect to the equity risks involved. Leasing forgoes a portion of the total income in order to avoid any chance of equity loss while part-equity ownership exposes the equity held to some risk of loss but retains the full product of the farm out of which to accumulate further equity. In this respect the two forms of tenure represent two very different uncertainty situations. In both there is uncertainty of future income and low or negative net income means a slower rate of financial progress and greater hardship to the family. In the case of part-equity ownerships, however, there is an additional source of

TABLE 2. COMPARISON OF INCOME VARIABILITY FOR THREE FORMS OF TENURE, SIX IOWA TOWNSHIPS, 1917–1948

Measure	Tenure	County and township					
		Appanoose, Washington	Howard, Saratoga	Monona, Jordon	Montgomery, Lincoln	Polk, Lincoln	Scott, Sheridan
Coefficient of variation	Owned	106	75	85	81	69	68
	Lease	252	102	93	103	75	72
	Part-equity	161	101	127	139	105	88
Relative mean of first differences	Owned	52	55	45	52	37	39
	Lease	127	89	49	64	43	42
	Part-equity	79	74	67	89	56	50

uncertainty in that previously accumulated equity might be endangered by adverse income.

In the comparison of forms of tenure presented in Table 2 share leasing has been used with the landlord getting two-fifths of the oat crop and one-third of the corn crop. The part equity ownership contract assumed 50 percent original equity and the remainder amortized over a 33-year period.

The absolute variability of net income is much lower under share leasing than under part-equity ownership. Even with its lower level of net income the relative variability is still, in general, lower under share leasing than under part-equity ownership. In view of the different equity risks involved further consideration has been given to the coefficient of variation as it can be interpreted to indicate the incidence of negative net incomes. This indicates a greater incidence of negative incomes with part-equity ownership. Since the equity risk involved is much greater in part-equity ownership this adds further support to higher estimated uncertainty under this form of tenure than under share leasing. The combined considerations of income variability and security of equity of the firm then, yield the conclusion that there is less uncertainty in leasing for the beginning farmer than in part-equity ownership.

The first two counties tabulated in Table 2 do not conform to the pattern of relative degrees of uncertainty discussed above. Checking with Table 3 shows that these are low productivity and low income situations. This indicates that share leasing is not a low uncertainty alternative in a low productivity area. In this regard it can be observed that the proportion of leasing is lower in the low productivity areas. While this is consistent with the above conclusion it does not imply that lower uncertainty is the sole criterion of decisions in these areas. A higher proportion of ownership is encouraged by the lower amount of money required to purchase low productivity land because of its correspondingly lower sale price.

TABLE 3. AVERAGE CORN YIELD AND AVERAGE NET INCOME FROM WHOLE CASH GRAIN FARM, SIX IOWA TOWNSHIPS, 1917–1948

Item	County and township					
	Appanoose, Washington	Howard, Saratoga,	Monona, Jordon	Montgomery, Lincolm	Polk, Lincoln	Scott, Sheridan
Average corn yield (bu.)	30.0	37.8	39.7	47.1	63.1	67.8
Average net income ($)	1722	2649	2776	3167	5833	4510

The general conclusion that share leasing involves less income uncertainty than part-equity ownership applies specifically to the particular equity situation assumed. This conclusion, then, applies only to the type of situation considered and must be adapted to accommodate the process of development through which the firm progresses. Share leasing involves less uncertainty than low-equity ownership but as capital assets are accumulated under leasing a level of assets could be achieved where high-equity ownerships would represent a lower uncertainty alternative to share leasing. If equal quantities of resources are available for either leasing or part-equity ownership the scale of operation would be larger with share leasing which would give a faster rate of (cash) asset accumulation and so shorten the period of leasing before high-equity ownership is possible. Frequently, however, limitations of the family labor force and availability of land to lease prevent the full utilization of available resources in leasing.

Yield Insurance

No agricultural program can remove technical uncertainty[10] from agricultural production. Crop insurance has been suggested, however, as a

[10] Technical uncertainty, as used here, refers to the uncertainty arising as a result of unpredictable variations in physical yields in agricultural production.

means of mitigating its impact on individual farmers. Government sponsorship has been sought in this area because of the difficulty of attracting commercial enterprise. The technical uncertainty facing individual farmers can be resolved to a risk for society as a whole but this risk is distributed over time for all farms together rather than between farms within one year as in the case of fire insurance.

If organized on a physical yield basis the insurance program would have the effect of "ironing out" fluctuations in yield. A constant number of

TABLE 4. COMPARISON OF INCOME VARIABILITY FOR TWO CROP INSURANCE PROGRAMS, SIX IOWA TOWNSHIPS, 1917–1948

Measure	Type of Insurance	County and Township					
		Appanoose, Washington	Howard, Saratoga	Monona, Jordon	Montgomery, Lincoln	Polk, Lincoln	Scott, Sheridan
Coefficient of variation	None	106	75	85	81	69	68
	Yield	100	76	77	79	76	71
	Cost	99	73	81	78	67	67
Relative mean of first differences	None	52	55	45	52	37	39
	Yield	59	54	51	55	49	47
	Cost	48	52	43	48	35	38

bushels of grain would be surrendered each year by the farmer as a premium payment and in years of low yield corresponding indemnity payments would be received. Ignoring the cost of administration of such programs, its effect on income variability has been summarized in Table 4.

The effect of yield insurance on income stability is not very large. In general what effect it has, however, is to increase income variability. This result is contrary to what has been postulated, even in a high productivity area such as Iowa.

The ineffectiveness of yield insurance in reducing uncertainty is attributable to the method of collecting premiums and paying indemnities which has been used. The annual premium was calculated as the cash equivalent of a constant number of bushels of grain. Indemnities were calculated as the cash equivalent of the number of bushels the yield was below the long-time average. Price is normally higher in a low-yield year than in a high-yield year. This means that small cash premiums were collected in high-yield years and large cash payments were made in low-yield years. With an inelastic demand total income is already higher in low-field years when the large indemnity payments are made. A yield insurance program operated on this basis would widen income fluctuations and so increase income uncertainty.

It is correct to say that this result observed above is a product of the

method of calculating premiums and indemnities. This choice is not an error in selection but the product of our experience with the management of storage programs. The result encountered could be avoided if transactions were in kind. The grain itself would not have to be exchanged directly between individuals and the insuring agency. Payment could be made in money provided the insuring agency bought the corresponding amount of grain into storage in high yield years and sold it out of storage in low yield years. It is in the latter operation that a government agency would encounter difficulty. There would be substantial opposition to the sale of stored grain in years of low yield and implied income hardship among farmers.

Cost-of Production Insurance

What is referred to here as cost-of-production insurance is not directed at technical uncertainty. It is directed at net income. In adjusting income experience under this program direct payments were calculated to have been made in years of negative net income and corresponding deductions were made from net income when it was a positive return. Again the costs of administration were ignored.

As indicated by Table 4, a cost-of-production insurance program had a consistent effect of reducing income variability. While in a statistical sense these reductions are relatively small their economic significance is very important. The incidence of negative net incomes from corn production is very infrequent in Iowa and those occurring in oat production are very small relative to total income. Even within this restricted scope of potential influence the cost-of-production type of insurance was consistently effective in reducing income variability. This would suggest that it could be expected to have a very considerable effect in reducing income variability under less stable conditions of physical productivity.

Policy Conclusions

The application of the finding of this study at the policy level resolve largely to recommendations of the type of policy approach which would seem most useful in reducing income uncertainty. While it is possible that a yield insurance program could be effective in reducing uncertainty, if it were accompanied by a storage program, it is very unlikely that the accompanying storage program would ever be accepted. It would require that grain be bought into storage in high yield (low price) years and sold out of storage in low yield (high price) years. The accumulation of the grain would be popular in that it would support price in low price years. The sale of stored grain, however, would tend to depress a high price and would be so unpopular that it would be very unlikely to occur. In this

case the storage program, accompanying yield insurance, would revert to a surplus removal program on an indefinite basis.

Contrasting the ineffectiveness of yield protection or guarantee with the considerable effectiveness of cost-of-production insurance, a general conclusion is suggested regarding the most fruitful avenue of approach in agricultural policy. These results are supporting evidence for the thesis that agricultural policy, designed at reducing income uncertainty, must deal directly with income instead of dealing independently with the price and yield components of income. If agricultural policy is considered to be directed at income support or redistribution the case for direct attention on income itself instead of price or yield is even more clear cut. Price and yield programs are not only of very limited effectiveness but are also regressive to those who have high production and usually correspondingly high incomes.

The suggestion of directing policy at income itself finds it most direct action proposal in a negative income tax. Questions of scope, desirability and acceptability of such a proposal remove any action potentialities from it completely. Even an insurance program based on cost of production would pose tremendous administrative difficulties. A very important point is demonstrated, however, in that a program is more effective in reducing uncertainty if it is directed at net income. Even though a flexible price support program might be the most timely mechanism for this purpose at a particular time it is of paramount importance to recognize that the basis to which support of any kind should be tied is the income of the farmer and not the product of land.

In considering agricultural policy directed at reducing income uncertainty to farmers the national policy objective of a high and stable level of employment and income in the economy cannot be ignored. While not being a direct guarantee of farm income it has other effects. It is a good guard against continued low prices in agriculture and the general atmosphere of prosperity facilitates the financing of efficient production to achieve higher incomes in agriculture.

BRITISH POST-WAR POLICY TOWARDS FARM MECHANIZATION

JOHN W. MELLOR*
Cornell University

WORLD WAR II and its wake of trade crises, acute labor shortage and a great backlog of consumer demand have forced British attention to means of increasing total agricultural output and output per worker in agriculture. Increased mechanization of agriculture as a means of meeting this challenge has been an integral part of British policy since the beginning of the war in 1939. Subsequent progress in mechanization has been marked. Agricultural tractors in England and Wales increased from 45 thousand in 1939 to 267 thousand in 1952; milking machines on farms more than tripled in number from 1942 to 1952; and the number of combine harvesters rose from practically nothing to over 16 thousand (Table 1).[1] *The Economic Survey for 1948* set forth as government post-war policy provision of agricultural machinery to the home market of more than £40 million per year, at least until 1950-51.[2] This goal has been more than met in each of the succeeding years in conjunction with a substantial and increasing export business, and at a time when materials were exceedingly short.[3]

British public policy has played a leading role in this growth of agricultural mechanization. For a variety of reasons mechanization has contributed less to the goals of increased food production per capita and per acre and more to other values than might have been wished by the policy planners. It is not, however, within the scope of this paper to analyse the contribution which mechanization has made to specific goals. The discussion is directed only to public policy as it has impinged upon mechanization in order to illustrate principles of the mechanization process and to provide lessons in directing public policy towards increased mechanization, if such is judged valuable. This policy has been largely

---

* The author wishes to express his appreciation to the late A. W. Ashby, former Director of The Agricultural Economics Research Institute, Oxford, for his aid in carrying out the original research project from which this paper is drawn and the Fulbright Commission for providing the funds which financed the research, and to F. F. Hill and K. L. Robinson of Cornell University for their aid in preparing this paper for publication.

[1] Most of the data in this article are for England and Wales, occasionally data for Great Britain and the United Kingdom are used. The trends and relationships shown for one can in each case be considered representative for the others.

[2] *Economic Survey for 1948*, Command Paper 7344, March 1948, H.M.S.O., p. 35.

[3] "Machines and Men," *The Farmer's Weekly*, November 30, 1951, Vol. XXXV, No. 22, p. 37.

by indirection. Increased supplies of farm machinery and machinery pools were direct measures. Other measures such as increased incomes and income tax privileges have affected mechanization indirectly, but no less forcefully.

Availability of Suitable Machinery

Mechanization in Britain was set back greatly after World War I when an influx of ill-adapted machinery seriously weakened farmer's faith in

TABLE 1. INCREASE IN MACHINERY NUMBERS, ENGLAND AND WALES, 1942–1952[a]

Year	Three and Four Wheeled Tractors	Milking Machines	Combine Harvesters	Complete Sugar Beet Harvesters	Potato Spinners
1942	90,260	23,860	940	[b]	28,590
1944	134,170	30,560	2,400	[b]	41,630
1946	153,650	40,360	3,250	180	46,980
1948	193,530	48,130	4,970	230	52,340
1950	245,400	69,170	10,120	840	59,610
1952	267,390	80,750	16,470	1,450	61,990

[a] June 4 Agricultural Returns.
[b] Not available.

the benefits to be derived from mechanization. More recently the values of mechanization have been fully accepted, but progress has still been slowed by equipment less well adapted to British conditions than that which modern technology is capable of providing. Pre-war, the bulk of Britain's farm machinery was imported from America. Although very important to Britain, exports never represented more than 15 percent of total United States' agricultural machinery sales.[4] The American industry was devoted mainly to the domestic market and, indeed, concentrated on certain parts of that. As a result machinery was often ill-adapted to British conditions. The need for smaller, more maneuverable tractors and equipment, for more rugged machinery and for combines with larger threshing capacity per foot of mowing capacity are examples of the kind of modification needed, but available only after a delay harmful to the progress of further mechanization.[5]

Growth in Britain's agricultural machinery industry has come rapidly

[4] Exports of farm machinery by the United States varied from 7 percent to 15 percent of total sales between 1935 and 1940 and of this Canada normally took about 25 percent.

[5] Political and Economic Planning, *Agricultural Machinery*, PEP, February 1949 p. 18; and MacGregor, J. J., *Some Economic Considerations in the Use of the Combine Harvester, Farmer's* Report No. 16, Harper Adams Agricultural College, July 1942; also, Cambridge University Department of Agriculture, *Threshing by British and American Machines*, Bulletin No. 10, June 1946.

in the past decade. Until the establishment of the Ford Works, at Dagenham in 1933, there was no large-scale agricultural machinery industry in Britain. By the end of 1950 the sole imports needed for a vastly expanded machinery demand were small quantities of specialized equipment, and moreover 52 percent of the total value of agricultural tractors and machinery produced was exported.[6]

Enlightened public policy played an important role in this development. The Dagenham tractor plant was kept producing tractors throughout the war and the production of many other agricultural machines was encouraged. Post-war policy continued to favor the industry by preferential treatment in obtaining steel and other short materials. In the *Economic Survey for 1948* the government looked favorably on European Recovery Plan proposals for expansion of agricultural machinery exports from Britain, and considerable effort was made to meet the stated goals.[7] Aside from its salutary effect on the balance of payments, the much criticized government policy of encouraging exports of agricultural machinery during the post-war period of very short home supplies will probably prove of great long-term value insofar as it developed and stabilized a foreign market for British agricultural machinery. The replacement demand of the domestic market is hardly adequate to support the mass production industry which is such an asset to the continued mechanization of British agriculture. The size and trend of present exports and the emphasis on selling to nations demanding a type of product suitable to British conditions would indicate that the export market will be a complement to the home market.

Wage Rates and Farm Machinery Prices

One of the strongest stimuli to increased mechanization in Britain has been the substantial increase in agricultural wages relative to the price of farm machinery.[8] Even the index of minimum farm wages rose from the pre-war base of 100 to 274 in 1950 compared with a rise to 183 in the farm machinery price index (Table 2). These figures substantially

[6] "Britain's Agricultural Machinery Industry," *The Times Survey of British Agriculture,* December 1951.

[7] *Op. cit.,* p. 34.

[8] Hired labor forms a more important part of the agricultural labor force in Britain than in most nations. The 1951 agricultural returns for Great Britain showed 812 thousand workers in the agricultural labor force, excluding operators and their families and children attending school. Of this number, 640 thousand were regular full-time workers. This compares with some 350 thousand full-time farm operators. On the basis of data from the *National Farm Survey 1941-43,* Ashby and Smith calculated that 46 percent of the full-time workers were on holdings employing five men or more. A. W. Ashby, and J. H. Smith, "Labour Organization of Farms," *Journal of Proceedings of the Agricultural Economics Society,* Vol. VII, No. 4, March 1948. p. 355.

understate the actual increase in farm wages. On the basis of survey data, Palca and Davies calculated that in early 1949 the weekly minimum wage had increased 172 percent above 1938, while the actual earnings per hour were up 212 percent.[9] The additional increase was due to changes in working hours, overtime rates and wages above the minimum.

The sharpest spur to agricultural wages came early in the wartime period. It was then recognized that maintaining and especially enlarging the agricultural labor force without major wage increases would be

TABLE 2. COMPARISON OF INDEXES OF FARM MACHINERY PRICES, FARM WAGES, FARM INCOMES AND AGRICULTURAL PRICES, ENGLAND AND WALES, 1938 AND 1946–50

Year	Farm Machinery Prices[a]	Minimum Farm Wages[b]	Farm Incomes[c]	Agricultural Price Index[d]
1938	100	100	100	100
1946		215	297	203
1947		241	320	236
1948	170	260	408	244
1949	176	270	475	255
1950	183	274	472	264

[a] Calculated from data in PEP, *Agricultural Machinery*, monthly data in "Farm Mechanization," and data from the Ministry of Agriculture and Fisheries.

[b] Weighted average minimum wage paid to ordinary adult male farm worker.

[c] Calculated from Income from Farming, *National Income and Expenditure of The United Kingdom, 1946 to 1950*, Command Paper 8203, with adjustments for income to spare-time farmers and others not mainly engaged in commercial farming, and dividing by an estimated 360 thousand farmers in each of the years. Figures for United Kingdom.

[d] Price index for all agricultural products, *Monthly Digest of Statistics*.

impossible when full employment made alternative opportunities so abundant. In accordance with stated policy following the Restrictions on Engagements Order of 1940, agricultural wages have tripled bringing them to near parity with the more slowly rising wages in industries to which agricultural workers have ready access.[10] Tighter control of industrial wages facilitated holding agricultural machinery prices to a 70 percent rise to 1948, when price controls were removed. Since then farm

Farm Incomes

The level of farm incomes is of primary import in determining the ability of farmers to finance machinery purchases. This aspect is emphasized in Britain by lack of a well developed system for provision of short

[9] H. Palca, and I. G. R. Davies, "Earnings and Conditions of Employment in Agriculture," *Journal of the Royal Statistical Society*, Vol. CXIV, Part 1, 1951, p. 50.

[10] E. Meyer, *Agricultural Labour in England and Wales*, Part II, "Farm Workers Earnings 1917-51," Loughborough, 1951, p. 73.

machinery prices have about kept pace with the rise in farm wage rates. and intermediate term credit. Government policy has been actively directed to raising farm incomes. The average net farm income per full-time farmer rose from an index of 100 in 1938 to an index of 472 in 1950 (Table 2). Even deflating by a cost of living index, farm incomes have more than doubled since 1938.

During the post-war period, increased farm incomes via higher agricultural prices have provided a capital injection for increasing agricultural efficiency and output. It was stated policy that the marked increase in prices in 1947 was intended to put into farmer's hand the funds for purchasing machinery and making other improvements.[11] Thus expansion of net farm income, £40 million in excess of increased production costs, was justified.[12]

High farm incomes are certainly favorable to increased expenditure on mechanization, but there is no guarantee that the income will be used in that manner. The acquisition of farm machinery may be far down the scale of farmer's preference. When such a specific end as increased capital expenditure is desired more direct measures are more efficient. *The Economist* puts the position cogently by stating that it would be better to supply finance directly for specific forms of capital equipment and "not merely to hope that the higher standard of living of farmers might overflow a little into the machinery pool."[13] Another article in *The Economist* points out that "the distribution of equipment on the basis of inflated demand is the least selective and most costly way possible," and that "it is the opposite of socialist theory since it involves putting windfall profits into the pockets of some farmers, to encourage others."[14]

In practice, however, the efficiency of increased incomes as a spur to mechanization has been greater than one might expect. The effectiveness of higher incomes in increasing mechanization is reinforced by policies which abate uncertainty regarding future price and income relationships and upon tax policies, both of which have created a climate favorable to long term capital investment.

Uncertainty

Expectations concerning future incomes are important to decisions regarding capital expenditure. In mechanizing, the farmer assumes fixed cash costs which may be increasingly difficult to bear if a period of de-

[11] *Economic Survey for 1948, op. cit.*, page 36; and *Annual Review and Fixing of Farm Prices, 1951*, Command Paper 8239, May 1951, H.M.S.O., p. 7.

[12] For a review of the procedure see W. E. Heath, "Agricultural Price Policy in the United Kingdom," *This Journal*, August 1951.

[13] *The Economist*, August 16, 1947.

[14] *The Economist*, September 27, 1947.

clining farm incomes ensues. Uncertainties regarding future incomes are not as important to the progress of mechanization for those British farmers employing highly unionized hired labor. For them, labor cost may represent as nearly a fixed cash burden as does machinery cost. Uncertainty is important to the progress of mechanization on the family farm, for there, labor cost is as variable as income. The less stable agricultural income, the greater the uncertainty and the less effective will be current measures for increasing mechanization.

Instability had been a mark of British agriculture ever since its "golden age" in the 1870's. Successive waves of foreign competition and economic depression engendered an attitude quite inimical to the kind of investment presented by increased mechanization. The progress of mechanization was undoubtedly slowed in the 1930's by this factor and it could have been a strong deterrent to mechanization in the post-war period.

Recent British policy has lent assurance to farmers that the present level of incomes could be expected to continue into the future. The need for greater agricultural production during World War II encouraged legislation implementing this policy. The peak in progress towards the reduction of uncertainty came with the Agricultural Act of 1947, codifying the forward pricing which had prevailed during the wartime years.[15] Also mitigating the effects of uncertainty are the high income policies themselves and tax provisions conducive to rapid payment of the capital cost of machinery.

Tax Policy

British income taxes at a near 50 percent rate and higher, place a premium on modes of spending which can be written off as business expense, while sales taxes of 66 percent and more discourage spending on many consumer goods.

For tax purposes, most farmers use the "wear and tear allowances" which allow an annual write-off on farm machinery of from 12½ percent to 28½ percent of the depreciated value—the latter figure is for tractors. The 1945 Finance Act, which raised allowances to this level, also provided for an initial allowance of 20 percent of the purchase price which could be written off the first year—an allowance subsequently increased to 40 percent in 1949, but discontinued in April, 1952.

None of these arrangements for faster rates of depreciation allow an addition to the total amount of depreciation chargeable over the whole life of the equipment. They do cause a considerable reduction in the time taken to reach a residual value. Before the cessation of initial allowances a total of 68½ percent of the value of a tractor could be written

[15] W. E. Heath, *op. cit.*

off the first year. Thus, if income was taxed at a 47.5 percent rate, the tax bill could be reduced the year the tractor was acquired by a sum equal to 32.3 percent of the cost of the tractor.

The real value to the farmer of such depreciation rates, often greatly exaggerated, actually depends on the level of incomes. Until income is high enough so the tax rate reaches 47.5 percent, the fast write-off is of only limited significance inasmuch as the next tax rate below is only 27.5 percent. With the rates and allowances in operation up to 1952, a married farmer with two children would not reach the point of paying 47.5 percent on his marginal income until his net income reached £700. In 1950 the average net farm income per full-time farmer was roughly £800. Figures from the National Farm Survey for the year 1945-46 (when the average farm income in that sample was roughly comparable to the average for all full-time farmers in 1950) show that only 31 percent of the farmers had incomes over £800 and only 42 percent had incomes over £600.[16]

For the farmer in an income bracket which makes the allowance effective, the substantial reduction in tax payments in the year of acquisition serves as a loan toward purchase of the machinery. It is often spoken of as an interest free loan, however, the "interest" could turn out to be high. In fact, the marginal rate in the average farm income bracket rose, in 1951, from 45 to 47.5 percent. Use of the fast write-off just prior to 1951 understated incomes when the marginal tax rate was 45 percent and overstated them when the rate was 47.5 percent.

It is as a hedge against unfavorable changes in incomes that the fast tax write-off has the greatest value. If present incomes are favorable to acquisition of machinery, it may be acquired and the tax that is avoided during the period of quick write-off can be applied to rapid amortization of the purchase, thus reducing the cash drain in the future when incomes may not be so favorable. If incomes fall enough to place the farmer in a lower tax bracket, the tax saving has been real and the cost of the machine has been lowered to the extent of the tax saving. A decline of that magnitude is not unlikely since the average farm income is near the division between the 47.5 percent and the 27.5 percent bracket.

There can be no doubt as to the effect on mechanization of the fast write-offs. Witness the heavy backlog of orders for farm machinery in early 1952 stipulating that the machinery be delivered before the cessation of the initial allowances in April. The value of the hedge and loan features of this tax policy has been enhanced by the ignorance of some farmers as to what the real savings or losses might be. If a farmer thinks of the fast write-off as a real reduction in the price of machinery, then it

[16] Ministry of Agriculture and Fisheries, *Farm Incomes in England and Wales, 1944-45 to 1947-48*, H.M.S.O., 1950.

will have the same effect in stimulating buying as if this were really the case.

Machinery Pools and Cooperatives

The government financed wartime machinery pools were one of the most direct measures instituted to accelerate farm mechanization. At the outbreak of war the County War Agricultural Committees organized machinery pools to own and operate farm machinery purchased by the government. About half the machinery available from 1942 to 1946 was allocated to the machinery pools.[17] During the war about 50 pools were formed, but when equipment became more readily available to the individual farmer, the pools dropped out of existence and only three survived as machinery societies of a cooperative nature.[18] In addition to the pools, in 1942 a few machinery cooperatives were formed, but despite continued encouragement by the Ministry, in 1947, there were only eight active machinery coops in England and Wales.

Machinery pools seem to have been a successful means of spreading machinery when supplies were short and vast new plowing-up schemes were being instituted. In the case of plowing-up, heavy equipment was needed which individual farmers would not want to buy for such limited use. The pools could acquire such equipment and receive a great deal of use from it. However, under more normal conditions of plentiful machinery and no subsidization the pools seem to be much less attractive.

For most economic use of pooled machinery one needs uniform areas of contiguous small farms. In Britain, small farms are not as numerous as in the continental countries and the large and the small farms are so interspersed that considerable expenditure is required in administering a pool and in moving machinery from farm to farm. The climate places a further burden on equitable sharing of machinery as the machinery is wanted by all at one time. In addition, conditions which permit the individual farmer to acquire his own machinery easily militate against successful operation of machinery pools.

Acreage Per Farm

Part V of the 1947 Agricultural Act authorized procedures to alleviate the problems of fragmentation of farms, poor field layout and small size of farm—all factors inimical to mechanization.[19] In 1951, a plan was

[17] E. M. Owen, "Co-operative Mechanization in France, the Netherlands and England and Wales," *The Farm Economist*, Vol. VI, No. 5, 1949, p. 119.

[18] *Ibid*

[19] The importance of these problems is well illustrated in: Ministry of Agriculture and Fisheries, *National Farm Survey of England and Wales (1941-43)*, A Summary Report, H.M.S.O., 1946, p. 35; and Agricultural Economics Research Institute, Oxford, *Country Planning, A Study of Rural Problems*, Oxford University Press, 1946.

prepared for Yetminster in Dorset in which 39 holdings and 1,637 acres were to be "defragmented." A popular outcry against the plan has successfully killed it up to the present, but the plan and the Act remain.[20] It is possible that more success would be attained if future plans were drawn in closer consultation with the farmers than occurred in Yetminster.

Aside from the unsuccessful Yetminster venture, British public policy has done little to effect enlargement of farms. Indeed, the policy of high farm incomes has made incomes acceptable on farms far from the optimum size, thus reducing the economic pressure to combine such units into larger sizes.

The available evidence indicates, however, that further increases in farm size may be of less importance to successful mechanization in Britain than is sometimes realized. The great emphasis which her fickle climate places upon timeliness of operation and the predominance of heavy soils combine to place a premium upon having a large amount of machinery per acre.

Data from a 1947-48 farm management survey in the southern province of England indicate that although the drop in machinery investment per acre is from £7.4 to £5.1 from the strata of farms under 100 acres to the strata of farms from 100 to 300 acres, there is only a drop to £4.9 per acre for the farms over 300 acres in size.[21, 22] Other figures for England and Wales show that two-thirds of the tractors on farms of over 100 acres are on farms with more than one tractor and that nearly a quarter of the farms with tractors in the 50-99 acre strata have more than one tractor.[23] A study quoted by Sturrock of a sample of eastern county farms in 1947 and 1948 related work units per man to size of farm and showed for those two years a relatively small increase in work units per man once a farm had passed 100 acres in size.[24]

These studies indicate consistently that greater economies in the use of machinery have not been general on farms of over 300 acres as compared with those of 100 to 300 acres in size. Those smaller than 100 acres in size represent about 30 per cent of the total area of crops and grass in England and Wales.[25] Size of farm itself may occasionally limit mechani-

---

[20] *Farmer and Stock-breeder Yearbook*, 1952, p. 67.

[21] Claude Culpin, *Farm Mechanization: Costs and Methods*, London, 1951, p. 12.

[22] It is conventional in British size of farm statistics to exclude rough grazings in stating acreages in farms.

[23] *Agriculture, Journal of the Ministry of Agriculture*, August 1951, Vol. LVII, No. 5, p. 207.

[24] E. G. Sturrock, "The Productivity of Labour in Agriculture," *The Proceedings of the Conference of the Agricultural Economics Society*, July 1950, Vol. IX, No. 1, p. 34

[25] D. K. Britton, "Are Holdings Becoming Larger or Smaller?," *The Farm Economist*, August 1950, Vol. VI, No. 7, p. 188.

zation in this group, but it is not nearly the problem that gross figures lead us to expect. Much of this land is not in commercial agriculture and much of it is in intensive truck farming.

Summary

British public policy has affectively pushed towards increased mechanization of agriculture. Measures encouraging the domestic farm machinery industry, rising farm incomes, legislation effectively reducing price uncertainty, rapid depreciation rates for tax purposes, and a policy which encouraged increased labor costs relative to machinery prices have all contributed to increased mechanization.

While the policy of rapidly raising farm incomes favored increased mechanization, farm incomes were already high enough so that other measures might have been as successful and more efficient. High incomes on small farms reduced the incentive to enlarge the acreage of farms. In the post-war years subsidization of machinery pools would not have been as successful as direct subsidies to farmers for specific machinery purchases. A careful development of intermediate term credit facilities and a more tactfully executed defragmentation policy might also have been more efficient devices than the capital injection through higher incomes.

COST ALLOCATION IN RELATION TO WESTERN WATER POLICIES*

S. V. Ciriacy-Wantrup**
University of California

1. Focus of This Paper

COST allocation in the sense of apportioning joint costs of multiple-purpose projects to individual products (purposes) has been of considerable significance for western water policies in the past.[1] It will be of even greater significance in the future: an increasing proportion of water resources development is taking place in the form of large, public, multiple-purpose projects. There has been an intimate connection between cost allocation and several basic and vital policy issues. These issues will be called here "economic feasibility," "repayment," "rate making," "yardstick," and "form of contract." It appears fitting that the spotlight of economic analysis be thrown on these issues.

Focusing on the connection between these issues and cost allocation entails some unavoidable sacrifices. These should be made clear at the outset in order not to arouse a reader's expectations which cannot be fulfilled.

First, not *all* important aspects of the above policy issues can be considered here. For example, the issue of "economic feasibility" has several crucial aspects—such as the definition and quantitative determination of so-called "secondary" or "indirect" benefits and costs—which have no necessary connection with cost allocation. These other aspects are in great

---

* An earlier version of this paper was presented before the Conference on Western Water Resources Development, March 2-3, 1953, Berkeley, California, under the title "Economic Analysis of Water Resources Policies." Giannini Foundation Paper No. 136.

** Professor of Agricultural Economics and Economist in the Agricultural Experiment Station and on the Giannini Foundation.

[1] The term "joint costs" is employed here is a shorthand for "costs in joint production." The logical corollary is "separate costs." In multiple-purpose projects, it is advisable to differentiate between production and distribution. The distribution of products—for example, of water and power—can generally be regarded as separate processes. However, in some cases, a part of distribution must be included in joint production.

The term "separable costs" is avoided here. This term is employed in current practices of cost allocation. It is defined as follows: "the separable cost for each project purpose is the difference between the cost of the multiple-purpose project and the cost of the project with the purpose omitted." In connection with these same practices, "joint costs" are defined "as the difference between the cost of the multiple-purpose project as a whole and the total of the separable costs for all project purposes." U. S. Federal Interagency River Basin Committee. Subcommittee on Benefits and Costs: Proposed Practices for Economic Analyses of River Basin Projects. Washington, D.C., 1950. 85 p. Quotations are from p. 54.

need of economic analysis.[2] But such an undertaking cannot be embarked upon at this time.

A second sacrifice follows from the first. Since we cannot possibly analyze all important aspects of the issues mentioned, we cannot attempt to provide a detailed blueprint which would provide precise substitute procedures for those which are presently in use by public agencies operating in this field. For example, concerning the policy issue of "repayment," detailed proposals as to how payments under various conditions may be computed, assessed, and collected are beyond the scope of this study. However, we can clearly indicate the connection between repayment and cost allocation and draw conclusions with respect to certain broad but important changes in present procedures.

Third, the connection of cost allocation with water policies touches upon some knotty problems of economic theory. This is not a paper on the economic theory of joint production but an economic analysis of policy issues closely related to each other through their connection with cost allocation in procedures now in use. It is unavoidable, therefore, that some conclusions based on the economic theory of joint production are supported by references to other publications which supplement the present analysis. Otherwise, the focus would be blurred.

2. *Experience with Cost Allocation*

The problems of cost allocation have been discussed in numerous committees and commissions. There is a voluminous literature on the subject written by engineers, lawyers, accountants, and economists. After lengthy arguments, sometimes reminiscent of medieval dialectics on ecclesiastical dogma, the conclusion is invariably reached that cost allocation must be more or less arbitrary.

As a consequence, total joint costs of a multiple-purpose project are allocated among the various products in such a way as to afford an acceptable compromise of the divergent interests of federal, state, and local

[2] Striking differences sometimes occur in the benefit-cost analysis of different federal agencies for the same project. For example, in the recent Trinity River report, the Bureau of Reclamation calculates a benefit-cost ratio of 3.26:1 and the Federal Power Commission, a benefit-cost ratio of 1.5:1. (Trinity River Basin, Central Valley Project, California. House Document No. 53, Washington, D.C., January 9, 1953.) The Corps of Army Engineers does not use indirect benefits in the same sense as the Bureau of Reclamation. The Federal Power Commission has gone on record that "reliance should be placed upon the more direct or primary types of benefits and costs susceptible of being evaluated." Survey reports on upstream flood control by agencies of the Department of Agriculture show an increasingly critical attitude in matters of evaluation. Reports on Bureau of Reclamation projects on the other hand sometimes show "indirect" benefits equal to or exceeding "direct" ones. The Federal Interagency River Basin Committee is experiencing difficulties in resolving these differences among the agencies in the field of evaluation.

governments and of municipal and private users of water, power, navigation, recreation (including fish and waterfowl), and other products.[3] Because of the existing connection between cost allocation and the important policy issues mentioned, these divergent interests are strong and sensitive. Reference is always made to existing laws, precedents, engineering data, and economic concepts. The initiated, however, will probably agree that "rationalization" is not too strong a word for the kind of economic reasoning used to justify cost allocations recommended to Congress or other bodies who make the final decisions on authorization and appropriation.

It may be submitted that this state of affairs will not change until it is clearly recognized by those who analyze, recommend, and authorize projects that the problems of economic feasibility, repayment, rate making, yardstick, and form of contract are quite different economic issues. They require different approaches and different sets of tools for their solution. These approaches and tools, in turn, have little relation to past and present practices of cost allocation.

After stating the main theme in these negative terms let us see what can be said positively to clarify the issues of economic feasibility, repayment, rate making, yardstick, and form of contract without falling into the semantic traps of cost allocation.

3. *Cost Allocation and Economic Feasibility*

Determination of economic feasibility in federal multiple-purpose projects is connected with cost allocation through statute—for example, through the important sections 9 (a) and 9 (b) of the Reclamation Act of 1939.[4] Statutes differentiate between reimbursable and nonreimbursable costs and stipulate different proportions between these two kinds of costs for different purposes, such as irrigation, power, municipal water, navigation, and flood control.

As interpreted by the most important public agency operating in this field, there are two standards for determining economic feasibility. Both standards must be met by a project. They may be stated in the words of Commissioner Strauss in his testimony before Congress:[5]

> The first, required by reclamation law, consists of an allocation of project costs among the purposes served and a showing that the anticipated project

[3] The various methods of cost allocation that have been used or considered need not be discussed here. The most important methods are reviewed in a recent congressional report. Subcommittee to Study Civil Works of the Committee on Public Works: The Allocation of Costs of Federal Water Resource Development. House Committee Print No. 23, December 5, 1952. Govt. Print. Off., Washington, D.C. This report will be cited henceforth as "Allocation Report."

[4] Act of August 4, 1939, Ch. 418, 53 St. 1187, 43 U.S.C. 485.

[5] Allocation Report, p. 11.

revenues will return all reimbursable costs. The second, although not required by reclamation law, is the showing of estimated benefits and costs, and is made as a matter of Bureau policy. Thus, a reclamation project must meet two standards of economic feasibility: The estimated benefits must exceed the estimated costs and the anticipated project revenues must provide for return of all reimbursable costs.

The first standard mentioned by Commissioner Strauss is a standard for the possibility of repayment under the requirements of present laws. Sometimes, this standard is referred to as "financial feasibility." In the statutory sense it is a necessary condition for feasibility. In the economic sense it is neither a necessary nor a sufficient condition for feasibility because, in multiple-purpose projects, reimbursable costs include only a portion of total costs and project revenues only a portion of total benefits. Moreover, which portion of costs is designated as reimbursable and which portion of benefits has to be repaid as project revenues are not determined on the basis of a functional relation between costs and benefits.

The second standard does not involve cost allocation. It is a necessary condition for economic feasibility, provided that benefits and costs are properly evaluated.[6] It is a sufficient condition for economic feasibility under three restrictive assumptions: (1) that the benefit-cost ratio of the project considered cannot be further improved; (2) that there are no alternative projects with a higher benefit-cost ratio on which available public funds could be spent; and (3) that it is desirable to make public funds available.

In order to determine economic feasibility, that is, to make a recommendation on economic grounds whether a public project should be undertaken and when, one must ascertain in the planning stage the optimum proportion of products for various time intervals and the optimum quantities of products at that proportion. In more technical language, we want to determine the direction and the length of an optimum product vector extending over time. In order to avoid a term that has been little used by economists, this vector will be called the "optimum product combination."

Neither the proportion of different products yielded by a multiple-

[6] As stated in Section 1, it is not possible at this time to go into the important problem of evaluating benefits and costs (including the use of interest and uncertainty allowance). This problem is not peculiar to multiple-purpose projects. The principles involved in obtaining market and extra-market values have recently been discussed elsewhere. (S. V. Ciriacy-Wantrup, *Resource Conservation, Economics and Policies.* University of California Press, Berkeley, 1952. 410p.) Some of the procedures presently in use have been critically reviewed in a recent congressional report. (Subcommittee to Study Civil Works of the Committee on Public Works: Economic Evaluation of Federal Water Resource Development Projects. House Committee Print No. 24, December 5, 1952. Govt. Print. Off., Washington, D.C. This report will be cited henceforth as "Evaluation Report.")

purpose project nor the quantities of these products at given proportions are fixed and constant over time on the basis of engineering or other technological data. For example, the Central Valley Project in California can be planned, constructed, and managed to yield water, power, and flood control—to mention only the three most important products—in various proportions and in various quantities for each proportion. Construction can be delayed or speeded up, and the yield of products can be varied over time. Decisions in this sphere do not merely concern the consumers of these products, but also affect deeply the relations between federal, state, and local governments.

In focusing on these decisions, three broader aspects of economic feasibility, already alluded to are left out of consideration. This omission happens to be in accord with the political realities which at present determine authorization and appropriation. These aspects are the following—in increasing order of broadness.

First, there is the question whether a similar product combination could not be obtained more economically by alternative projects in different geographic locations—for example, by supplemental irrigation, drainage, clearing, and fertilizing projects in the humid portions of the United States.[7]

Second, there is the question whether alternative public projects with an entirely different product combination may not be preferable. For example, public investment in the conservation of natural resources may compete with public investment in slum clearance, schools, hospitals, and the like.

Third, there is the question to what extent funds should be withdrawn from the private sector of the economy and invested in public projects. An answer to this question depends on the type of project and on the phase of economic fluctuations; beyond that, problems of taxation, public credit, and the effectiveness of the whole system of private enterprise need to be considered.[8] To some extent, the answer to this question can be arrived at through appropriate practices in evaluating benefits and costs. This is not possible with the first two questions.

Economic analysis can make a contribution in clarifying these three aspects of economic feasibility. But joint-cost allocation is not immediately involved.

---

[7] For an interesting, although controversial, beginning toward a quantitative analysis of "western" and "eastern" alternatives, see Rudolph Ulrich. "Relative Costs and Benefits of Land Reclamation in the Humid Southeast and the Semiarid West." *This Journal*, vol. XXXV, no. 1, February, 1953, pp. 62-73.

[8] On these points, see S. V. Ciriacy-Wantrup. "Taxation and the Conservation of Resources." *The Quarterly Journal of Economics*, vol. LVIII, February, 1944, pp. 157-195. S. V. Ciriacy-Wantrup. "Resource Conservation and Economic Instability." *The Quarterly Journal of Economics*, vol. LX, May, 1946, pp. 412-452.

4. Determining the Optimum Product Combination

It is not necessary to treat the economic theory of joint production in detail at this time.[9] Cost allocation in the sense of obtaining the total costs of a project first and then apportioning them to individual products is meaningless for obtaining the optimum product combination. The approach is different. The optimum product combination yields the total costs, which need not be allocated for determining economic feasibility. What is needed are the marginal benefits and costs of various products in the sense of partial derivatives of total benefit and cost functions. The independent variables of these functions are the rates of production of various purposes planned for various time intervals.

Theoretically, such partial derivatives can be calculated. This possibility, however, has little practical relevance. In actuality, approximations must be used. It is practical to calculate the present value of the expected flow of total benefits and costs from a small number of alternative (dated) product combinations. For each of these alternatives, in turn, benefits and costs may be calculated for various assumptions with respect to evaluation—for example, for various interest rates and prices of products and cost factors. Superior product combinations can be selected on the basis of benefit-cost ratios.

Usually, economic feasibility of only one product combination constant over time and based on only one set of assumptions with respect to interest and prices is calculated and submitted to Congress. By the time the political decision about construction is made, prices (including interest) may have changed—for example, in the course of economic fluctuations. Mistakes can be reduced if the submitting agency has thoroughly considered alternative product combinations and price assumptions and if the decision-making political body has a clear idea of what such changes mean in terms of benefit-cost ratios.

State and local governments, universities, and private groups of potential beneficiaries should participate in—or at least should have an opportunity to scrutinize—the determination of the optimum product combination. The Columbia Basin Joint Investigations and the Central Valley Project Studies have pointed the way. However, these studies were started too late and were not concerned with *ex ante* economic feasibility. Such studies should be completed *before* a project is recommended. Differing opinions of state and local governments and of potential beneficiaries, together with appropriate material to substantiate such opin-

[9] For a detailed treatment, see S. V. Ciriacy-Wantrup. "Economics of Joint Costs in Agriculture." *This Journal*, vol. XXIII, no. 4, November, 1941, pp. 771-818. An application of this theory to problems of "time jointness" is offered in *Resource Conservation, Economics and Policies, op. cit.*

ions, should be submitted to Congress with the report of the agency responsible for recommending.[10]

In determining economic feasibility, no consideration should be given to direct and indirect subsidies. At present, such subsidies are given—for example, in the form of interest-free funds to individual purposes (irrigation). If comparison is made between taxed and tax-free value flows, an appropriate correction for this difference becomes necessary. Likewise, no consideration should be given in determining economic feasibility to whether costs are reimbursable or nonreimbursable. The extent to which subsidies and tax exemptions are granted and costs are regarded as reimbursable are important policy decisions for determining repayment but not for determining economic feasibility (see Section 6).

5. *More Liberal Standards of Feasibility?*

As noted, determination of economic feasibility must be understood as a critical appraisal of whether a project should be undertaken at all, when, and with what product combination. The objective of such determination is *not* to find an economic justification for a project which appears desirable to an agency or to a pressure group. There is a tendency to focus on such a justification and on attempts to liberalize standards for appraisal. These attempts are not helpful in eliminating existing weaknesses of benefit-cost analysis.

Besides constituting a retrogression in analytical method, these attempts have undesirable practical effects. Usually, water development for municipal and industrial uses and for power has high benefit-cost ratios as compared with irrigation use. Attempts to liberalize standards of economic and financial feasibility are concerned with irrigation use. Thus, if competitive relations exist between municipal and industrial uses and power on one side and irrigation use on the other, liberalization of feasibility standards leads to a change in the optimum product combination to the disadvantage of the former. In other words, multiple-purpose projects in which irrigation is the dominant use of water will be undertaken in preference to those in which municipal and industrial uses of water are more significant. From the standpoint of *future* water needs, such a development is especially questionable. In most western states, water needs for municipal and industrial uses are increasing rapidly.

The most extreme attempt to liberalize standards of economic and

---

[10] In some legislation—in the Flood Control Act of 1944 and the River and Harbor Act of 1946—it is stipulated that individual projects planned by federal agencies must be submitted to the states for review and that the latters' comments must accompany requests for appropriations. (Sections 1 (a) and 1 (c) of Flood Control Act, 1944. Public Law 534, 78th Congress. In the Amendments of 1945 and 1946, these provisions were reemphasized.)

financial feasibility is the suggestion to replace economic analysis simply by objectives imputed to the reclamation laws, namely, "to settle the arid lands of the West and further the economic development of the nation."[11] It is claimed for these objectives that "the policy implications are clear."[12]

Even if one accepts these objectives, should no priority be given to economically feasible projects? In many parts of the West, projects and purposes compete not merely for public funds but, more importantly, for scarce water resources. The dispute over the water of the Colorado River is an outstanding example. Granted that such disputes are finally decided in the political arena—that is, in this case, through court decisions, compacts, and treaties—is it in the public interest to eliminate costs in the consideration of benefits? Can economic evaluation be discarded as a tool for taking into account the welfare of *all* groups and regions? Can the decision about what priorities and what product combinations are to be recommended to Congress be left entirely to subjective judgment? Or do those who use the above argument contend that there are no economically feasible projects in western water resources development and that there is no objective basis for making selections between alternative product combinations?

6. *Cost Allocation and Repayment*

Let us now turn to the problems of repayment. Recommendations of multiple-purpose projects and studies like those mentioned for the Columbia Basin and the Central Valley have given a great deal of attention to cost allocation in connection with repayment. Statutes, executive orders, and traditions have made the allocation of total construction costs to various project purposes the basis of repayment. According to these same social institutions, costs allocated to some purposes need not be repaid at all; some purposes need not pay the interest portion; other purposes must repay all costs allocated to them including interest; for still other purposes, allocated costs include costs which other purposes cannot repay.[13]

This institutional situation would lead to strong and sensitive interest in cost allocation even if no connection between repayment and rate making existed. Beneficiaries who must repay allocated costs are interested that the largest possible proportion of total costs is allocated to

[11] J. Karl Lee, "Irrigation Policy for Arid Lands." *This Journal*, vol. XXXII, no. 5, December, 1952, pp. 751-755. Quotations are from p. 754.

[12] Policy implications are said to be these: "(1) the liberalization of existing policy with respect to repayment requirements, (2) the elimination of alternative opportunity or cost in the consideration of benefits, (3) repayment would become a secondary consideration, (4) acreage limitation would be continued, and (5) antispeculation would be continued."

[13] In the Act of 1937 authorizing the Central Valley Project of California, power is designated as "a means of financially aiding and assisting other functions." This role of power goes back to the Reclamation Act of 1906.

purposes the cost of which need not be repaid. Navigation, flood control, recreation (wildlife), and national defense, for example, are often burdened with higher cost allocations than are warranted by their relation to costs and to benefits received. Generally, the Department of the Interior has been in favor of such shifting of cost allocations while the Corps of Army Engineers and the Federal Power Commission have been more conservative.[14]

Among beneficiaries, such shifting of cost allocations is favored mainly by users of water and power. Cost allocations to water and to power, on the other hand, are influenced by a more complex grouping of interests. Frequently, irrigation interests are in favor of high cost allocations to municipal water and to power. With respect to cost allocations to power, this tendency is supported by private power interests because of the connection between cost allocation and rate making. This connection will be discussed presently (Section 7).

If irrigation is based to a considerable extent on ground water and, therefore, on electric power, pressures exercised by beneficiaries become even more complex. The positions taken in these matters by California farm organizations and the political alliances formed are interesting for the student of western water policies.

To summarize: Cost allocation for purposes of repayment has been a much broader institutional problem than the term would seem to indicate. From the standpoint of future water policy, it would be desirable to recognize this situation frankly and to separate problems of repayment entirely from any reference to construction costs and their allocation. What, then, could be the basis for repayment?

It appears economically justified and politically equitable that beneficiaries from public resource development pay for the benefits received—provided such benefits are practically assessable and provided that enough incentive is left for beneficiaries to participate in resource development. Payments under these provisions are the best guarantee that the determination of economic feasibility will receive the most thorough scrutiny by state and local governments and by private groups of beneficiaries. As suggested above, such scrutiny appears necessary if all aspects of economic feasibility are to be considered in the planning stage.

For some projects, the principle just suggested, namely, that assessable benefits and not costs are to be repaid, may mean that more is paid by beneficiaries than the total costs of a project. For other projects, the principle may mean that only a small portion of total costs is repaid. For

---

[14] For examples in the area of the Southwest Power Administration, see Allocation Report, pp. 15-26. For examples in the Missouri Basin, see Missouri Basin Survey Commission: Missouri, Land and Water. Washington, 1953, p. 92.

still other projects, it may mean that payments are about equal to total costs. Payments may go to a reclamation fund or, preferably, to the general treasury fund.

It may be noted that the principle suggested here is not identical with the various "benefit methods" used in cost allocation.[15] The principle has broader implications. It does not solve *all* problems of "speculation" and of "unearned" increments of income and capital caused by public projects. But it goes far enough in this direction to offer a more effective and economically more acceptable alternative to present policies designed to reduce speculation and unearned increments—for example, the so-called "160-acre limitation."[16] This is especially true if the water furnished by public projects is supplemental to other waters in already developed irrigation areas, as in the Central Valley of California.

As a matter of public policy, it may be desirable not to assess certain benefits even if it is practical to do so. Recreational benefits may fall into this class. Some benefits are not practically assessable to natural or legal persons. Benefits to national defense are an example.

As a corollary of this policy, it may become an important part of federal policy to induce state, local, and private agencies to plan and build their projects with full consideration of benefits to recreation and national defense. Various forms of "inducements" appear practical and have been used in other connections.[17] Besides making repayments for such benefits, the federal government may stipulate consideration of such benefits when the use of federal waters and land is involved. Under some conditions, tax incentives may also be used.

One important point regarding repayment needs to be mentioned at this time, although a more detailed discussion must be deferred until later (Sections 7-9): The assessment of benefits for repayment should not

---

[15] The name "benefit method" is applied mainly to two methods of cost allocation. The first allocates the total costs of a project among the purposes "in proportion to their estimated benefits." The second allocates to each purpose its "direct cost plus a share of the joint costs in direct proportion to the estimated net benefits." Allocation Report, p. 4.

[16] The quotation marks are used because the quantitative definition of acreage limitation is, to a large extent, left to the discretion of the Secretary of the Interior. By statute "160 acres" is mentioned as a maximum. It can be—and has been—reduced by the Secretary of the Interior to as low as 40 acres for some projects. On the other hand, the limitation has been interpreted in such a way that man and wife may operate 320 acres. According to another interpretation, this figure can be increased even further by transferring land to other members of the family.

Sometimes, the pressure of economic and political change forces a change in the rulings of the Secretary. For example, the Orland Reclamation Project in California has been operated under a 40-acre limitation from 1916-1953 (from 1907-1916 a limitation of 160 acres was in force). In 1953, a uniform limitation of 160 acres was decreed.

[17] Ciriacy-Wantrup, *Resource Conservation, op. cit.*

determine unit prices of products sold—that is, for example, water and power rates. On the other hand, assessment for repayment is usually dependent on such prices. The form of repayment may be directly connected with such prices (power and water revenues) or may be made in the form of various types of taxes and fees. Not only power and water users but as many other beneficiaries as can practically be assessed should participate in payments.

Evaluation for determining repayment is not necessarily identical with evaluation for determining economic feasibility. For example, some localized benefits which may be assessed for repayment may be offset in the determination of economic feasibility by costs elsewhere in the economy. On the other hand, as already mentioned, in the determination of repayment some benefits—for example, to recreation (wildlife) and national defense—which are important in the determination of economic feasibility may not be assessed for reasons of policy or practical expediency.

Determination of economic feasibility is strictly *ex ante*. Determination of repayment is partly *ex post*. That means repayment is subject to revision if actual benefits should prove different from expected ones. However, repayment is facilitated if methods of assessment, form of repayment, and expected quantities and values (rates, taxes, fees) are clear to all parties concerned at the time when economic feasibility is determined. For example, beneficiaries of power can enter into purchase agreements with the federal government with the understanding that rates will be set according to principles discussed in the next section. If payments are to be made by beneficiaries in the form of taxes and fees to local and state governments, agreements on methods of assessment can be formulated.

Such an early arrangement for repayment has two advantages: first, the determination of economic feasibility will be taken seriously by all parties concerned; second, less difficulty will arise in disposing of products and in repayment after the commitment for the project has already been made; such difficulty has arisen, for example, in the Central Valley Project. In other words, the federal government—and the taxpayers—will not be left holding the bag.

7. *Cost Allocation and Rate Making*

As suggested in the beginning, determination of water and power rates is an economic issue quite different from that of repayment. Problems involved in the determination of water and power rates may be considered next.

At present cost allocation is directly connected with rate making in the

Bonneville Project Act of 1937.[18] In other legislation, the connection between cost allocation and rate making is indirect but nevertheless effective. Two factors are mainly responsible. First, net revenues obtained from the sale of water and power are by far the most important—and thus far have usually been the only—financial source of repayment. Second, in view of the statutory differentiation between reimbursable and nonreimbursable costs, all reports on public multiple-purpose projects contain implications or direct suggestions about rates "necessary" to support cost allocations to water and power or to make these purposes "self-supporting."

This connection between cost allocation and rate making is recognized by all federal departments involved.

General Lewis A. Pick, Chief of Army Engineers, stated in his testimony before Congress:[19] "Rates for sale of this power [that is, power produced by projects built by Army Engineers] are established by the marketing agency upon approval by the Federal Power Commission, and according to the law should return the cost of producing the power. Power rates are thus affected by the cost allocations made by the Corps of Engineers."

Secretary of Agriculture Brannan stated before the same congressional committee:[20] "The allocation of costs of multiple-purpose reservoir projects is important to agriculture insofar as it affects the charges to farmers for electric power and the reclamation of land by irrigation, drainage, and flood control."

Under Secretary of Interior Searles has this to say as a witness:[21] "Reasonable allocations are of the greatest importance because repayment requirements, which in turn govern power rates, are as dependent upon the allocations to reimbursable purposes as they are upon the actual construction costs."

Private power companies have taken a lively interest in this issue. This is explained by the frequent attempts to employ rates charged for public power as a "yardstick" for rates charged by private companies. So long as cost allocations in public multiple-purpose projects influence rate making, such allocations are indeed of concern to private power companies. On the other hand, if this connection between cost allocation and rate

[18] 50 St. 731. Section 7 reads in part: "Rate schedules shall be based upon an allocation of costs made by the Federal Power Commission. In computing the cost of electric energy developed from water created as an incident to and a byproduct of the construction of the Bonneville Project, the Federal Power Commission may allocate to the costs of electric facilities such a share of the cost of facilities having joint value for the production of electric energy and other purposes as the power development may fairly bear as compared with such other purposes."

[19] Allocation Report, p. 9.

[20] Allocation Report, p. 9.

[21] Allocation Report, p. 10.

making did not exist, one important reason for private power companies to oppose public projects would disappear.

Before we can analyze the economic soundness of the yardstick idea, we must inquire about the principles on which rate making may be based and about the significance—in terms of these principles—of past costs of physical plant.

Theoretically, the problem of setting rates for water or power can be approached with tools similar to those used in determining the optimum product combination.[22] A demand and supply function for water and power must be constructed. From the standpoint of social economics, a demand function can be interpreted as a marginal benefit function, and a supply function, as a marginal cost function. On this basis, an optimum (dated) product combination can be calculated.

For public projects, the physical plant can be adjusted to yield the optimum product combination without regard to price incentives. Rates can be set in such a way that supply and demand in each time interval are in equilibrium. For private industry, rates must be set in a way, first, that the optimum product combination results and, second, that supply and demand are in equilibrium in each time interval. To obtain these two results, rate making may have to be supplemented by tax incentives—for example, by provisions regarding depreciation allowances.

Such theoretical rates are not necessarily equal to short-run or long-run marginal costs of instantaneous economics. Rates set must make allowance for maintenance and discontinuous changes of physical plant in accordance with changes of demand and of technological conditions. Determination of such rates is possible only in economic theory. In the present case, as in the preceding one, practical approximations to theoretical solutions must be found. A proposal for such an approximation will be considered next.

8. *Rate Making and Public Utility Commissions*

The potentially most useful approximation to a theoretical determination of rates for public water or power may be based on the procedures developed by public utility commissions. In regulating rates, some of the more progressive commissions attempt to take into account expected changes of demand, the physical plant needed to satisfy such demand, the costs of such plant, "normal" efficiency of management, and "normal" profits to give an incentive to provide such plant.[23]

---

[22] The techniques and their difficulties and limitations are similar to those involved in determining the optimum state of conservation in social economics. For details, see Ciriacy-Wantrup. *Resource Conservation, op. cit.*, Chapters 16 and 17.

[23] In this connection, a statement by R. I. Mittelstaedt, President, California Public Utilities Commission, before the California Farm Bureau is of some interest. See *California Farm Bureau Monthly*, vol. 34, no. 4, April, 1953.

It may be admitted that many, possibly most, public utility commissions still look more toward the past than the future in appraising demand and "allowable" cost of physical plant. However, the various proposals for incremental cost pricing have started some healthy discussion.[24] For our purposes, the direction of change in public utility regulations and the possibilities of further improvement are more interesting than past and present shortcomings. On the other hand, it would be naive to forget that in a field so exposed to political pressures—like the field of rate making—considerations based on economic theory will be only one (and decidedly a minor) factor in political decision making for some time to come.

Besides the realities of political pressures, another factor which limits the immediate relevance of theoretical considerations must be mentioned. In order to have the desired effects upon future supply, rates regulated by public utility commissions must be realistic in terms of cost-accounting and budgeting practices used by private utility companies in planning maintenance and changes of physical plant. These practices differ from the techniques employed in the theoretical determination of the optimum product combination. Likewise, the practical definition of "normal" efficiency and profits poses some knotty problems. However, through give and take between public utility commissions and private utility companies over many years, cost-accounting and budgeting practices have been developed which are reasonably well suited as a basis for regulation.

Such practices are becoming required standards for private companies of the regulated industry. There is a tendency for these standards to become more uniform for jurisdictions of different utility commissions. There is also a tendency for these standards to improve. Modern cost accounting has become a highly skilled profession. Since the last war, cost accounting as a means of controlling prices and profits has been used on a large scale in negotiating defense contracts. A great deal of experience has been gained in this field.

9. *Rate Making for Public Water and Power*

Rates regulated by public utility commissions in a way that takes

[24] Harold Hotelling, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates." *Econometrica*, vol. XI, no. 3, July, 1938, pp. 242-269.

Donald Wallace, "Kinds of Public Control to Replace or Supplement Antitrust Laws." *American Economic Review*, vol. XXX, no. 1, March, 1940, supplement, pp. 194-212.

Temporary National Economic Committee. *Economic Standards of Government Price Control*. Monograph No. 32. Senate Committee Print, 76th Congress, 3d Session, 1941.

Emery Troxel, "Incremental Cost Determination of Utility Prices." *Journal of Land and Public Utility Economics*, vol. 18, no. 4, November, 1942.

Emery Troxel, "Limitations of the Incremental Cost Patterns of Pricing." *Journal of Land and Public Utility Economics*, vol. 18, no. 1, February, 1943, pp. 28-39.

account of supply and demand functions extending over time, and a wealth of cost data in the regulated private industry, can be used for approximating a solution of our present problem, namely, of setting rates for water and power produced by public multiple-purpose projects–for short, "public" water and power. Such rate making can be divorced entirely from the problem of cost allocation.

In the western part of the United States, conditions of demand and supply are such that any practically relevant addition–through public projects–to otherwise existing supplies of water and power can be absorbed without substantial reduction in rates. For demand, changes point strongly upward. Increases of supply have to come from greater distances, poorer sites, or steam plants. The latter generally produce at higher costs than hydroelectric plants.

Under these conditions, water and power produced by public multiple-purpose projects can be disposed of at rates corresponding with or only slightly below the rate structure as regulated by public utility commissions.

Such a price policy is opposed, not only by preference customers of public water and power (see footnote 25), but also by many public-spirited citizens because of "indirect" and "intangible" benefits of lower public rates–regardless of supply and demand conditions. However, in social economics, the effects of lower rates upon public revenues need to be considered, and also the possibility that such rates, in combination with rationing, may change consumption patterns to the disadvantage of those "higher" social uses which could compete successfully for available water and power at higher rates. Moreover, increases in the total volume of water and power available from public *and* private sources is no less important in social economics than decreases in rates. In other words, effects of price on future supply cannot be neglected.

It should be emphasized that we are talking about rates at the points of production—that is, at or near the multiple-purpose dams. Generally, these rates will be wholesale rates. Appropriate correspondence between wholesale and retail rates can be arrived at on the basis of cost data available to public utility commissions. Obviously, the seasonal distribution or "firmness" of the quantities available for sale must be considered. Under western conditions, water and power available at different seasons are, economically speaking, quite different commodities. Differences in firmness and in load factor are generally taken into account in the existing rate structure.

There are some geographic differences in the relevance of rates set by public utility commissions from the standpoint of rate making for public water and power. Existing rates regulated by public utility com-

missions are relevant in those regions where new public resources development is to be integrated into a large, already existing private development. This is the case, for example, in California. In other regions of the country —for example, in the Missouri Basin—recent public development of water and power is so important relative to the existing private development that the rate structure of public projects is more relevant for private projects than the reverse.

If no regulated rates are geographically relevant for a public project, or if there are potential customers of a public project who are willing to pay higher than the regulated rates, preference in the sale of public power and water may be given to the highest bidder.[25] Price discrimination in the sale of large blocks of power and water is frequently possible. In the case of public projects, such price discrimination is not necessarily objectionable.

The principle of highest bidder must be qualified with respect to imperfections in the capital market when transmission lines and distribution facilities are not available. For most projects, some major transmission lines must be constructed in any event in order to connect the project with existing systems and to serve other project purposes—for example, pumping plants. Such transmission lines are an integral part of the project. In some cases, public credit may be given to groups of customers who want to construct their own distribution facilities—for example, more than two billion dollars has been lent through the REA to rural cooperatives. These and other means to overcome imperfections in the capital market are outside our immediate field of inquiry.

10. Cost Allocation and the Yardstick Idea

In returning now to the yardstick idea, it has already been implied, in the reasoning about the absence of any necessary connection between cost allocation and rate making presented in the preceding sections, that rates set for water and power produced by public multiple-purpose projects cannot be used as a yardstick to measure whether the rates charged by private utility companies are too high. Even if it is assumed that rate making for public water and power is not based on the principles just discussed, but on allocated costs, such costs would not be comparable with those of private companies: the latter are generally not favored by the economies of joint production and tax exemptions.

Rejecting the yardstick idea does not mean that rates charged by

[25] With respect to public customers, this preference is regulated by law. A public-preference clause in some form has been in the Reclamation Law since 1906. It was reaffirmed through Section 9 (c) of the Reclamation Act of 1939. A discussion of the economics and politics of public preference would lead us too far afield.

private utility companies are always justified. Economic possibilities for rate reduction exist largely with respect to retail rates. As already stated, we are concerned mainly with wholesale rates. The spread between the two types of rates is great—especially for power. Costs of transmission and distribution represent by far the greatest portion—around 80 per cent and more—of total power costs at points of consumption.

If, in a given situation, rates charged by private power companies lead to monopoly profits, the most direct relief is brought not by using cost allocation as a means to justify lower rates for public water and power but by making existing public utility commissions more effective in their highly important regulatory functions. There are several practical possibilities of doing this. At present public utility commissions fall short of fulfilling the important role assigned to them here. However, they are an institutional device, developed by a democratic society, which gives promise of further development.

11. Cost Allocation and Form of Contract

By separating repayment and rate making entirely from cost allocation —as advocated in the preceding sections—another problem of water policy can be clarified. This problem is the form of the contract entered into between the government agency responsible for construction and marketing —particularly the Bureau of Reclamation—and the water users—particularly the irrigation districts.

The two principal forms of contract have become known as the 9 (d) and 9 (e) contracts in reference to the relevant subsections on the Reclamation Act of 1939. The 9 (d) contract is a repayment contract; it provides for repayment of allocated reimbursable costs within time periods specified in the Act. The 9 (e) contract is a service contract; it does not provide for repayment but merely for water service over a number of years (40) under conditions also specified in the Act.

Construction costs of water distribution systems are covered by 9 (d) contracts. Construction costs of the main project works, on the other hand, can no longer be treated in the same way—or at least that is claimed by the Bureau of Reclamation—because the resulting payments would exceed the financial ability of the districts. The 9 (e) contract, therefore, has become more and more common, since it became available through the 1939 Act, and is now frequently employed in large, multiple-purpose projects. For example, in the Central Valley Project, all contracts concluded so far are 9 (e) contracts, and according to announcements by the Bureau of Reclamation, this situation will not change in the future.

Although the 9 (e) contract is financially more attractive than the 9 (d) contract, it creates problems which are not presented by the latter. With-

out going here in detail into the somewhat controversial and legally complex nature of these problems, they may be summarized with respect to the most important point: the security of water rights.

A repayment contract leads to a definite transfer of administration and operation of physical works—and, therefore, of permanent control over water deliveries—to the water users themselves.[26] By contrast, under a service contract, the Bureau of Reclamation retains control over administration and operation indefinitely. The Bureau claims it is legally free to make changes in water deliveries from one group of users to another after the time period specified in the contract (40 years) has expired. No provision for renewal is contained in the contract nor provided for in present federal law.

It can be argued that changes in water deliveries would create so much opposition in Congress that the attempt would not be made. However, Congress is usually divided in such matters. Security of water rights is so important in irrigation farming that the present weak substitute for a renewal clause is not sufficient.[27] This is especially true of the Central Valley Project in view of the large expenditures by the irrigation districts in constructing distribution systems. It may be submitted that the rights of users of water produced by federal multiple-purpose projects should not be less secure than other water rights established and protected by the laws of each state.

There is no need to argue here the question of state law versus federal law so often referred to in this connection. For the purposes of this paper, the issue is primarily an economic one: an optimum development of irrigation farming in an institutional system based on private initiative cannot be expected if the security of water rights is uncertain. For the economist, such uncertainty would be relevant even if it were merely subjective. Subjective uncertainty influences the economic decisions of water users.[28]

Security of water rights under state laws does not mean that such rights cannot be transferred from one user to another. Water rights, being real property, are bought and sold—with land if they are "appurtenant" or without land if they are not—in all western states. By and large, such transfer of water rights through an open market gives sufficient flexibility for adapting to changing economic conditions. In some cases, water

[26] According to the reclamation laws, nominal ownership of the main dams and reservoir sites remains with the federal government.

[27] Frequent criticism of 9 (e) contracts in California has led in recent contracts to an addition to the preamble reading as follows: "and such future contracts as may be made between the United States and the District."

[28] For a more detailed discussion of the effects of uncertainty upon resource use, see Ciriacy-Wantrup. *Resource Conservation, op. cit.*, Chapter 8.

rights can be transferred through loss, forfeiture, condemnation, and in other ways also defined under state laws.

Likewise, security of water rights under state laws does not mean that service contracts for water are undesirable. Many western farmers obtain their water from water companies on a contract basis. However, these water companies are public utilities operating and regulated under state laws. Such utilities are not free to shift water service to other customers.

Although insecurity of water rights is the most important problem raised by 9 (e) contracts, it is not the only one. Perpetuation of direct controls by a federal agency over the affairs of public districts organized and operating under state laws and supervised by state agencies has led to difficulties.

Here, again, there is no need to argue whether local, state, or federal control is preferable in water resources development. Neither federal, nor state, nor local governments are inherently superior with respect to the competence and integrity of their civil servants and with respect to freedom from corruption and rule by pressure groups.

On the other hand, too much concentration of economic power in any single agency—federal, state or local, public or private—appears undesirable. Although one may argue that economic power can be controlled by political power, in the end a system of countervailing economic powers appears safer. On the basis of this value judgment, federal, state, and local governments, together with private agencies, may well participate in water resources development. Some duplication and conflict may result from such multiplicity. As discussed elsewhere,[29] there are several practical possibilities to reduce these results through better coordination. The irreducible minimum of inefficiency caused by the multiplicity of participating agencies is the price paid for avoiding too much concentration of economic power.[30]

Regardless of one's attitude toward the over-all issue of federal versus state and public versus private control, it may be submitted that the scrambling of federal, state, and local law and government as brought about by the 9 (e) contract is unnecessary and undesirable. The internal economic affairs of irrigation districts are intrastate. The 9 (e) contract

---

[29] See Ciriacy-Wantrup. *Resource Conservation, op. cit.*, Chapter 21.

[30] Even the much criticized duplication of *federal* agencies in water resources development—for example, of the Bureau of Reclamation and the Army Engineers—may be considered from the standpoint of the above paragraph. At present, state and local governments may obtain consideration of their objectives by working with one of these agencies if they feel that their viewpoint is not sufficiently considered by the other. Differences are brought into the open. The much needed consolidation of the two agencies would be in accord with a system of countervailing economic powers only under the condition that state and local governments play a strong independent role in water resources development.

contains provisions which are irritating, to say the least, to local and state governments. For example, the final decision in interpreting many important clauses is left entirely to the "contracting officer," that is, to the Federal Commissioner of Reclamation or his representative. Institutional machinery for consultation and arbitration would be more appropriate.

Let us assume that use of water facilities created by a federal project is entirely intrastate. If repayment of benefits is arranged for between federal, state, and local governments, water rights vested in the federal government and control over administration and operation of water facilities may well be transferred to the state and, under appropriate agreements, to the water users soon after the project is put into operation. If costs have no connection with repayment, as explained in the preceding sections, individual parts of projects are independent from each other with respect to repayment. The problems created by joint costs, by the gradual completion of large projects—like the Central Valley Project—and by the financial inability of districts to repay allocated construction costs would no longer prevent transfer of control. Such transfer would overcome present objections against a water service contract that are based on insecurity of water rights and on federal control over affairs which can safely be left to the control of state and local governments.

There is no implication in the foregoing statement that control *must* always be transferred. There are several intrastate projects now in operation in which irrigation districts have preferred that the constructing federal agency remain in control.

Likewise, there is no implication that control over *other* features of an intrastate multiple-purpose project—for example, over power or flood control—should be transferred to water users. Such control *may* be transferred under adequate agreements protecting federal and state interests if that is desired by the water users themselves, power users, and other beneficiaries.

With respect to federal projects which have important interstate or international implication, the situation is different. It is difficult to see how control of such projects could be turned over to state or local governments. Most large multiple-purpose projects have interstate or international implications. Thus, the federal government should remain an important factor not only in the development but also in the administrative control of water resources. This is in accord with the position taken above concerning the principle of division of economic power. How far the states can actively and harmoniously cooperate with the federal government in the administrative control of such projects—for example through federal-state compacts—needs to be explored further.

Although the federal government should remain important in the ad-

ministrative control over interstate projects, secure water rights may still be acquired by the water users of each state. If use of water facilities is interstate, state allotments will have to be made in any event by state compact, international treaty, or supreme court decision, or by a combination of these. Water users may acquire water rights in these allotments according to the laws of each state. If a service contract for water is used, regulations of each state can be applied to its allotment.

12. Theoretical Analysis Versus Practical Application

It may be felt that an economic analysis of water resources policies has the dry taste of theory and cannot be applied to the political and legal facts of life. Economists restrict their own usefulness severely if they consider water policies only within the framework of present statutes. In many cases it is relevant to view laws as tools or obstacles of policy, and economists should make proposals for such changes.

Existing reclamation laws are not entirely antagonistic to the principles suggested here. With respect to the determination of economic feasibility and the processes of rate making, existing laws are not specific. In any event, for the solution of these two problems, only broad principles could be stated by law. Detailed practices must be worked out by professional staffs and through agreement between agencies and governments.

The 1939 Reclamation Act is more specific with respect to repayment through water and power sales. I have tried to show elsewhere[31] that each paragraph of the relevant Section 9 (a) is capable of an interpretation which is not in conflict with the principles suggested here. Obviously, it would be much better if economic reasoning were clearly expressed in the Act rather than read into it. A suitable interpretation is possible only because the economic terminology that appears in the Act is rather vague.

With respect to repayment in other form than through water and power sales, the present practice of regarding national defense and recreation as nonreimbursable may be continued. But benefits from flood control, salinity control, and navigation can, in part at least, be assessed for repayment. As already implied, this would have the advantage that these benefits receive closer scrutiny in determining economic feasibility. Further, in some cases, political opposition to desirable projects would be reduced. For example, the benefits of the Central Valley Project through flood control, salinity control, and navigation are geographically concentrated in the Central Valley. Taxpayers in other parts of the state, such

[31] U. S. Bureau of Reclamation. Central Valley Project Studies: Allocation of Costs, Problems 8 and 9. Appendix J. Letters of Comment and Dissent Submitted by Committee Members. Govt. Print. Off., Washington, 1947, pp. 235-238.

as southern California, receive only small, if any, benefits from these purposes. In other regions of the country, a similar differentiation exists between upstream and downstream interests in a big watershed such as the Missouri and Mississippi valleys. A more equitable participation of different groups of taxpayers in the financial burden of a project might facilitate authorization by Congress.

The most practical way of assessing the benefits from flood control, salinity control, and navigation would be through public districts, equipped with taxing power, formed for that purpose under state law. In the case of navigation benefits, economic arguments in favor of tolls exist. This country is reviving this principle for some important freeways. But the tradition of toll-free navigation is strong, and there are also economic arguments in favor of paying for navigation (and road) benefits in other form than through tolls.

All western states have had experience with public districts in the field of irrigation. Most states, especially California, have a variety of laws under which districts concerned with water resources development other than irrigation can be organized and operated. Likewise, it is a well-established practice that public districts enter into repayment contracts with the federal government.

A considerable literature exists on assessment practices in irrigation districts. Several studies undertaken in the Columbia Basin and the Central Valley have a bearing on assessment practices in districts other than irrigation. Further studies in this direction are desirable, but there is little doubt that practical means to repay benefits in the way suggested can be found.

By and large, changes in repayment as suggested here would mean a simplification of existing laws. Most students and interested parties are in agreement that amendment of reclamation laws is sorely needed. A codification of reclamation laws by the House Judiciary Committee is now in progress.

NOTES

A NOTE ON RAUCHENSTEIN'S ARTICLE ENTITLED "FORAGE GRAIN SUBSTITUTION: ITS IMPORTANCE IN THE ECONOMICS OF MILK PRODUCTION" AND McMILLAN'S NOTE ENTITLED "A DEMAND CURVE FOR COMMERCIAL DIARY FEED IN NORTHWESTERN PENNSYLVANIA"

IN VIEW of the controversy which took place in the February and May issues of *This Journal*[1] concerning the place and usefulness of the iso-product concept in Agricultural Economics research, production economists are particularly interested when Rauchenstein states that one purpose of his paper[2] "is to test the economic significance of the marginal rates of forage-grain substitution (iso-product type of substitution). . . ." The testing is done by computing net returns above feed at different points on an iso-product curve in the hay-grain dimension of Heady's milk production function for hay and grain.

In testing the economic (practical) significance of the marginal rate of substitution (along iso-product lines which, incidentally, is the time-honored, unconfused meaning of the concept), Rauchenstein did three things which reduce the validity of his test: *First,* he used the Heady[3] and Olson data fully recognized by them to be tentative and inconclusive.[4] *Second,* he tested only one of the two effects of changing the hay-grain price ratio on net returns to the dairy enterprise i.e., although changes in the ratio between the prices of the two inputs changes both the least cost combination of the two inputs involved and the most profitable level of output, Rauchenstein investigated only the first of the two effects. The *third* shortcoming in Rauchenstein's test is that he used state, annual, average prices of hay and grain. Although he does argue that important differences do not exist in hay prices between areas in Wisconsin, intra-year variations in hay prices as well as the area difference in hay prices known to exist in other states are entirely ignored. Thus, Rauchenstein's test is based on an incomplete economic analysis of tentative, inconclusive input-output data and price data which exclude price variations both

---

[1] E. O. Heady, "A Production Function and Marginal Rates of Substitution in the Utilization of Feed Resources by Dairy Cows" *This Journal,* Vol. XXXIII, November 1951, p. 485f, Ronald L. Mighell, "What is the Place of the Equal-Product Function," *This Journal,* Vol. XXXV, p. 29f and E. O. Heady and Russell O. Olson "Mighell on Methodology" *This Journal,* Vol. XXXV, May 1953, p. 269f.

[2] Emil Rauchenstein, "Forage-Grain Substitution: Its Importance in the Economics of Milk Production," *This Journal,* Vol. XXXV, p. 562.

[3] Heady, *op. cit.*

[4] Heady and Olson, *op. cit.,* pp. 273-275.

within years and within states. The evaluation which follows is that while the objective of testing the practical economic significance of the marginal rate of forage-grain substitution in dairy production is admirable it still remains unattained.

Rauchenstein's implication (incidentally the article does not state conclusions from his test in a forthright manner) that the marginal rate of forage-grain substitutions is unimportant can be questioned on another basis. If the results of Rauchenstein's present computations should continue to hold when *complete* economic analysis of *adequate* price and input-output data are made, very practical important changes (based incidentally on the marginal rate of substitution concept) would be called for in the recommended organization of dairy farms, i.e., if a given output of milk can be produced at little change in cost over a wide range of forage-grain substitution, we can discard the long followed recommendation that as much roughage be used as possible because T.D.N. from hay roughage are cheaper than T.D.N. from grain. Very practical important conclusions result from use of the marginal rate of substitution concept regardless of the results yielded by the type of test used by Rauchenstein.

It is also of interest to note that Wendall McMillan's note entitled "A Demand Curve for Commercial Dairy Feed in Northeastern Pennsylvania"[5] also runs into certain difficulties because his analysis ignores the marginal rate of hay-grain substitution in milk production. McMillan constructed three theoretical demand curves for dairy feed—one for each of the years 1941-42, 1942-43 and 1943-44. His theoretical demand curves are based upon the input-output data published in USDA Technical Bulletin 815. The data in that bulletin permit one to study hay-grain substitution along the stomach capacity line but not orthodox marginal rates of hay-grain subsitution along an iso-product line. When the "observed" quantities of dairy feed used on McMillan's representative farms are compared with quantities "predicted" from the theoretical demand curves, McMillan finds that the observed quantities used for 1941-42 and for 1943-44 are very close to those predicted but that the observed quantity of feed used in 1942-43 exceeds the predicted quantity by a very substantial margin.

A cursory check of the 1941-44 volumes of *Agricultural Statistics* reveals that the price of hay increased relative to the price of grain in Pennsylvania from 1941-42 to 1942-43 and that the price of hay in Pennsylvania fell relative to grain from 1942-43 to 1943-44. This shift in the hay-grain price ratio would logically result in the substitution of grain for roughage. The observed quantity of feed used indicated that the representative farms did just this. McMillan's theoretical demand curves, however, are based

[5] *This Journal*, Vol. XXXV, p. 606.

upon data and computations which ignore the marginal rate of forage-grain substitution and hence are incapable of reflecting such changes in the demand for feed. If McMillan's theoretical demand curves for feed had taken into account the marginal rate of substitution of grain for hay in milk production as influenced by the hay-grain price ratio, they might have successfully predicted the 1942-43 substitution of grain for hay, and hence, the 1942-43 expansion in the demand for grain.

Here again it appears that the marginal rate of hay-grain substitution concept appears to be relevant in agricultural economics research.

GLENN L. JOHNSON

Michigan State College

IS INDIA OVERPOPULATED?

BEFORE I came to India, two apparently inconsistent propositions about this country caused me some wonderment. First is the almost axiomatically accepted idea of overpopulation. On the other hand, although India is primarily an agricultural country, all statistics of land use show millions of acres of cultivatable wasteland. I wondered how an agricultural country could be so overpopulated and at the same time have so much idle land.

Since these two generally accepted propositions oppose each other, which one leads closer to an understanding of the true situation? Although support for the overpopulation idea is obvious, is seems equally clear that this idea rests on some lack of understanding of the India scene. This paper presents some tentative observations in an attempt to promote a more complete understanding of the situation.

The popular idea of overpopulation seems to come from two sources; from observation and from the study of population statistics in relation to the food supply. Casual observation while travelling in India or even during extended stays in India's urban areas certainly gives the impression of "teeming millions." Any town, city, or railroad station seems like Saturday night in the old home town most of the time. However, although India is full of people, Westerners tend to overestimate the actual numbers when relying on these general impressions because of one simple cultural fact. Indians actually use their houses very little.

A house is mainly a storage place for belongings and a place to stay when it rains. The rest of the year, most Indians are out of doors where they can be seen. They tend to congregate together at markets for buying and selling, at holy places, at religious celebrations and for many other reasons. These same areas tend to be the places generally visited by foreigners. In the villages, however, one tends to forget about overpopu-

lation. In a village community, everyone seems to have his house, his family, and his place in the community. Because of outdoor living, impressions of the teeming millions of India gained from observation tend to exaggerate the situation.

However, this is not the main source of the overpopulation axiom. One can turn to statistics to prove that Indians do not have enough to eat, though statistics actually are not necessary. In a land where only the rich are fat, results of substandard diets can be seen everywhere in villages and cities alike. Neither in quantity nor quality is the ordinary diet adequate. It is probable that poor diet is a root cause of the lethargy, inefficiency and hopelessness of the village.

An increase in dietary levels is a primary need of modern India. To accomplish this, either food production must be increased faster than the population or efforts must be made to reduce the number of mouths. It seems logical to say that if only there were less people in India, everyone would have more to eat; or that population increase must be stopped if even the present substandard dietary levels are to be maintained. Actually, in the present situation, the number of people seems to have slight connection with food production *per person.*

Consider, for a moment, how much food would be produced next year in India if, by some giant catastrophe, the population was halved at midnight tonight. I would like to suggest the premise that only about one-half as much food would be produced and that the ordinary diet would remain as substandard as at present.

This is perhaps an unusual answer after all we have heard about pressure on the land, unemployment in agriculture, fragmentation of holdings, and the other popular facts of Indian agriculture. Although it is based on experience in a wheat growing area, where both yield per acre and population are lower than in the rice tracts, it appears to apply to Indian agriculture generally. Both yield and population are greater in the rice areas but labor requirements are also greater for rice growing.

This idea that labor is the limiting factor in Indian agricultural production is based on the extreme seasonality of agricultural labor requirements and on the inefficient way this labor is applied to the land. Here in the wheat tract, there are only about two weeks when wheat can be planted. It is too hot before and too dry after this. Any seed planted at a marginal time will certainly result in a poor crop. Often there is a great visual difference in crops with only two days variation in planting dates. It is an unfortunate coincidence that the proper time for hay cutting also occurs during these two weeks. At harvest time another very short period occurs between sufficient maturity of the crop and its shattering. If the crop is not cut during this short time, loss is incurred.

In understanding the implications of this situation, it is necessary to

realize the primitive state of agricultural methods in India. Wheat is usually drilled with a wooden plow (iron tipped), one, or sometimes two, rows at a time and each acre requires one full working day for one pair of bullocks and two people. Harvesting is done entirely with a six-inch sickle and requires three woman-days per acre.

The supply of labor determines the number of acres which can be planted or harvested within the necessary time periods. During both of these periods, the common complaint in the villages is the shortage of labor. If a land owner is not forward in his planning, he is likely to find himself without planting or harvesting help. There often just isn't anyone available. In any village during the day in these two periods, only the very old, the infirm and the small children can be found. Everyone else, men, women, and children, are working just as hard and as fast as possible in the fields.

It will no doubt surprise many that a shortage of agricultural labor has been listed as one of the three major agricultural problems of this area in the Community Development (Point 4) Program. (The other two are the small renumeration from agricultural labor on a full-time basis and agricultural finance.) It is certainly true that in spite of using all available labor resources in the village, some crops are sown and harvested at marginal times and much good land is not used at all.

These facts clearly indicate one major reason for the large amount of cultivatable wasteland in India. Of course much of this land is marginal and more needs irrigation, but there is much land that is not being used because at the time the work must be done, there is no one to do it. This is certainly an observable fact in this wheat growing area.

The large number of mouths to feed, therefore, is not the crux of India's food shortage. Instead, the central problem is the low production per person in agriculture. Although everyone in the village works to his or her limit during the two periods of the greatest labor requirements in the year, there is still not enough food. Two factors cause this production per man hour to be so low that labor can hardly maintain itself. India's per acre crop yields are still about the lowest in the world for most crops. An increase of four times over the seed is considered a good wheat crop. The slow and inefficient methods of applying labor to the land represent the second factor. This has been illustrated above.

Until Indians learn to apply labor more effectively and to increase agricultural production per unit of labor, there is little hope of improving the average diet in India. The average man in India will not have more to eat until the average farmer produces more food. Reducing the amount of the labor resource or curtailing its increase will bring about very little increase in the effective use of this resource.

Actually, the term "overpopulation" has little meaning anywhere until

an area is using all its resources at the optimum level. Then, if some people still must live substandard lives, as then defined, the problem of overpopulation can be considered. Thus, if India has large areas of cultivatable wastelands, it can hardly be said that she has excess agricultural population. Little prospect exists that any area in the world will learn to use all its resources at their optimum level in the near future. Certainly India has hardly started to develop her potentials either in agriculture or industry.

As policies are at present being put into effect, an official government position on population control and reduction is being sidestepped and a policy more in line with the ideas presented here is being followed. This can be seen in many aspects of the new Five Year Plan. Perhaps one reason for this is that population control on a national scale would be impossible at present, but efforts to increase production per man have some hope of success. From the concepts presented here, it also seems to be more the realistic and adequate approach to the food problem.

JOHN FOSTER

American Friends Service

HOUSEHOLD INCOME, FOOD EXPENDITURES AND DESIRES IN SEATTLE, WASHINGTON*

THE purpose of this paper is to present some important economic implications which may be inferred from a study of food expenditures of households relative to incomes, of latent desires for additional food, of the commodities on which any desired additional expenditure would be made, and of the preferences for quality and services as well as additional quantities of food.

The food consumption relationships presented in this paper are based on a random area sample of households in Seattle, Washington, during September, 1950. Prelisted dwelling units were selected at random from each of the 80 census tracts. Budget, time and manpower limited the number of households in the study. The number of dwelling units selected in each census tract depended on the number of dwelling units in that particular tract relative to the total population. An alternate sample was similarly selected, and a systematic substitution scheme was vigorously adhered to throughout the survey.

The results of this particular study represent the economic and noneconomic relationships peculiar to the time of the study and particular market. Even so, it is highly probable that group behavior will be much

* Scientific Paper No. 1247, Washington Agricultural Experiment Stations, Pullman. Project Nos. 819 and 965.

slower to change than will individual behavior. It is recognized that people do not always respond similarly to a given economic environment. Nor are all consumer food expenditures, food desires, and quality considerations, motivated by economic reasons. Consumer actions are the result of a composite of forces, one of which is economic.[1] Moreover, their motives are not static but change over time with past experiences, expectations, and their relative position in society.

Income and Food Expenditures

Household food expenditures in this particular study ranged from $10 to $100 for the two-week period studied (Table 1). Although the dollar value of food expenditures was greater among the households with higher incomes, such expenditures represented a decreasing proportion of the

TABLE 1. FOOD EXPENDITURES BY HOUSEHOLDS IN DIFFERENT INCOME GROUPS, SEATTLE, WASHINGTON, SEPTEMBER, 1950

Household Income	Number of Households	Average Food Expenditure per Household	Percent of Households Spending the Following Amount for Food in 2 Weeks							Percent That Household Food Expenditures are of Household Income
			10-less	11-20	21-30	31-40	41-50	51-60	61-100	
			(Dollars)			(Dollars)				
$2,000 or less	108	26.29	8	41	29	9	7	3	3	43
$2,001 to $3,000	107	30.34	4	30	25	26	5	10	—	32
$3,001 to $4,000	169	40.79	—	9	24	25	24	13	5	30
$4,001 to $5,000	113	44.47	—	10	17	29	18	14	12	26
$5,001 or more	149	46.97	—	3	17	23	28	19	10	16
			(Percent)							
Total Average	646	38.71	2	16	22	23	18	13	6	

household income as compared with the lower income groups. For the over-all sample of households, approximately 25 percent of the income was spent for food. Given the income distribution, the income consumption elasticity for food was relatively low. The elasticity coefficient varied among income levels, with the highest values in the lower income brackets. This indicates that expenditures for food change very little among the higher income households when their incomes change.

Nutritionists and others maintain that not all household groups are adequately fed even during periods of full employment and prosperity.[2] Some have inadequate diets (according to nutritional standards) due to ignorance. Other households may have poor diets because of inadequate

[1] George Katona, *Psychological Analysis of Economic Behavior*, McGraw-Hill, 1951, pp. 63-190.

[2] *A Food and Nutrition Program For The Nation*, N.P.A., Planning Pamphlet No. 46, May, 1945, pp. 1-9; R. P. Christenson, *Efficient Use of Food Resources in The United States*, U.S.D.A. Tech. Bull. No. 963, October, 1948, pp. 6-11.

transportation and distribution. Low income, however, remains as the most important single factor associated with poor diets.[3]

Unsatisfied Food Desires

Seventy-three percent of the respondents indicated that with existing prices they could not properly feed their households for less than their present food expenditures. Sixty percent of the lowest income group desired additional food expenditures, while only 24 percent of the highest income group desired more. The greatest desire for additional food expenditures was among those households now spending the least amount of money for food. The higher income groups had fewer unsatisfied food desires, suggesting again the lower income elasticity coefficient of food expenditures by households in the higher income brackets.

Practically all of the additional money desired for food products was to be spent on three general groups of commodities including dairy products, fruits and vegetables, poultry and red meats. Only one percent of the respondents indicated other food groups, such as cereal products, and a few specialty items. The question of intent was limited to the broad classes of food products indicated above.

The responses relating to additional desires for fruits and vegetables, and dairy products were similar. Seventy percent of the respondents who desired more of either of these two food groups reported they would spend less than one-quarter of their extra food budget for them. A little more would be spent for fruits and vegetables than for dairy products. This pattern is relatively constant for all income groups, suggesting that of the three major general food groups, the income elasticity is lowest for the dairy product group.

Quite a different situation was indicated for poultry and red meats. Only 5 percent of the respondents reported they would spend less than 25 percent of their additional food budget for meat; 43 percent reported they would spend 26-50 percent of it for meat; 14 percent indicated they would spend 51-75 percent; and 38 percent would devote all of their proposed additional funds to the purchase of meats. Poultry and red meat represents the major portion of the unsatisfied food desires of these people.

Quality and service preferences are also less important with milk than either of the other two food groups. Only 7 percent of the respondents proposing to spend more on dairy products preferred unchanged quantities but better quality with more services. Fifty percent of the respondents indicated that they desired a greater quantity of dairy products with no

[3] *Cf.* W. W. Cochrane, *High-Level Food Consumption in the United States*, U.S.D.A. Misc. Pub. No. 581, p. 13, 1945.

change in services or quality, and 43 percent reported that they would like better services and quality as well as greater quantity.

Fruits and vegetables were halfway between the milk and meat product groups with respect to quality considerations, with 26 percent expressing a preference for a greater quantity only, and 63 percent indicated a desire for better services, higher quality and a greater quantity.

Desires for better quality were most in evidence with meats. Only 18 percent preferred more of the same kind of meat, 20 percent would be content with the same amount but wanted better cuts of meat, and 62 percent preferred a combination of the two.

In all the above instances, the highest per capita income families preferred the greatest amount of additional services and better quality.[4] Especially is this true for meat and fruits and vegetables. This is additional evidence that the coefficient of elasticity based on the value of consumption is greater than the coefficient based on physical consumption. Expenditures increase more than physical consumption, since better quality, greater variety, and more services are demanded. Certain commodities tend to stay fairly constant in their physical composition as farm products. But they may change substantially in value at the point at which consumers buy them, reflecting the amount and kind of non-farm services added in processing, handling, delivering, and serving these products as food. It is likely, then, that the greater portion of the additional food expenditures made by consumers when incomes rise will be directed toward these non-farm products particularly sought by those with greater purchasing power. Dairy products consumpion will be influenced less in this manner than will either of the other two food groups studied.

Economic Implications

This study substantiates the relatively low coefficient of income elasticity of demand for the three general food groups: dairy products, fruits and vegetables, and poultry and red meats. The Seattle food consumption study indicated that the income elasticity coefficient is higher when in terms of food expenditures than in terms of physical quantity purchased, and that poultry and red meat is the food group in which money expenditures are likely to be most flexible. Production shifts within the farm, as real incomes increase, will most profitably be toward livestock enterprises where possible.

A food subsidy to the low income groups to insure minimum standards of nutrition during periods of depressed national income will tend to have the effect of increasing and stabilizing the consumption of food, since the

---

[4] Similar findings are presented by A. D. H. Kaplan, "Expenditure Patterns of Urban Families," *Journal of American Statistical Association*, Vol. 33, pp. 97-98, 1938.

income elasticity is greater for low income than for high income groups. Historical data on agricultural production indicated that supply responds much more readily to price increases than to price decreases. Once farmers are committed to the necessary expenses of expanded production, they are reluctant to contract production even though prices and profits have decreased. The effect of a food subsidy under these conditions would increase farm income more than the amount of the subsidy. Higher income families not participating in the subsidy program will pay higher prices for approximately the same quantity of food. Participating families will purchase more food even though prices are higher under such a program.

One of the marketing implications of the elasticity coefficient of food expenditures, compared with quantity taken, concerns the marketing services and the quality of products consumer desire. Increases in purchasing power encourages more conpetition in marketing services and increased quality emphasis. Once consumers have become accustomed to given service and quality standards, marketing agencies tend to perpetuate these standards. All too seldom is the consumer given the choice between lower prices with fewer services, and higher prices and more services.

E. L. BAUM
I. L. CORBRIDGE

State College of Washington
Brigham Young University

THE FIRM AND INTERDEPENDENCY AMONG FIRMS*

CONCEPTS extended beyond their logical foundations produce erroneous results. In economic analysis a failure to recognize logical differences between analytical problems of the firm and interdependency among firms may yield erroneous results and discourage research from moving into potentially fruitful areas. The objectives of this brief essay are to explain the major differences in scope and economic logic between the firm and interdependency[1] among firms.

Important differences between firm and group analyses are of two kinds. Of the economic variables those "given"[2] for any analysis of the firm

* Suggestions of L. R. Martin and C. E. Bishop are gratefully acknowledged.

[1] Interdependency and macro relationships are concepts employed rather than "aggregate." It is believed that "aggregate" denotes the combining of units in a physical sense for the purpose of measuring physical quantities. The problem of economic interdependency is quite different from one of determining physical homogeneity for purposes of classification and physical measurement.

[2] Given denotes known or assumed for the purpose of any particular analysis; it does not necessarily mean fixed or constant.

are to be determined in analyses of macro relationships or interdependency among firms. Secondly, in problems that pertain to groups of individuals, those individuals are not likely to be indifferent with respect to the locus of the decision making process and the interdependence between political and economic behavior becomes of major importance. If the interdependencies among economic behaviors are to be determined, the problem cannot be solved by simply adding up the individual units nor treating the total economy as one firm.

Professor Leontief has described the character of the economic question very succinctly:[3]

"The procedure of the modern value theory comprises two clearly separable and fundamentally different types of analysis. . . .

"In the first stage of his analysis, the modern theorist simply reproduces the rational considerations of entrepreneurs engaged in the business of maximizing their profits, and describes the reactions of consumers seeking the best possible satisfactions of their wants. In principle, at least, each individual knows this part of economic theory and acts accordingly. For the theorist, it would be inadmissible to introduce at this stage of his analysis any other concepts but those which dominate the mind of actual producers and consumers. He explains their actions in terms of their own beliefs and fetishes.

"The opposite is true of the second part of economic theory, which could be called the theory of external interdependence. Here we analyze certain objective repercussions of individual economic activities entirely independently of the subjective attitude of the individual actors. As a matter of fact, and this has been repeatedly pointed out, a large part of theoretical analysis at this stage of argument is based on the assumption that the economic individuals concerned are ignorant of any such objective repercussions of their own activities. If they were to taste the apple of knowledge, their behavior would become fundamentally different and our theoretical system would turn false the very moment it became the property of manufacturers, workers, or consumers.

"At this level of the argument, the theorist actually removes the veil of subjective appearances and, instead of interpreting actions of economic individuals in terms of subjective motivations and beliefs, he explains these very beliefs and motivations in terms of objective actions and reactions."

For further discussion let us turn to particular problems. The objective of any economic analysis of the firm is to explain its economic behavior or to determine what action it would pay the firm to take. For this purpose

---

[3] Wassily Leontief, "The Significance of Marxian Economics for Present-Day Economic Theory," *The American Economic Review*, XXVIII (1), Supplement, March, 1938, pp. 1-9.

it would be meaningful to define a supply fuction as the relationship between product prices that might be offered and the quantity of the product that the firm would produce or offer for sale. The supply function of the firm would be identical with the *ex ante* marginal cost function where marginal cost lies above average variable costs; for optimum conditions, if there were a continuous function, marginal revenue must be equal to marginal cost where marginal cost is rising; otherwise, "greater

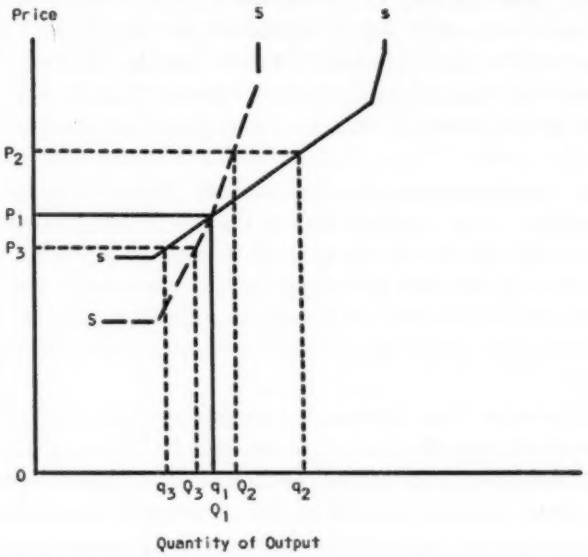

FIGURE 1. SUPPLY FUNCTIONS, INTERDEPENDENCY BETWEEN FIRM AND GROUP.

than" or "less than" in place of equality are appropriate terms. Beyond such an analysis of the firm the objective of the particular interdependency problem is to explain the economic consequences, particularly product prices, employment, output, and factor prices, when actions of firms are considered simultaneously.

Boulding has suggested that, "If the supply schedules of all the firms, actual or potential, associated with the production of a given commodity are known, the supply schedule for the commodity as a whole can be deduced by simple addition."[4] If the group is sufficiently large to affect values of factors or products, this statement is incorrect or the major problems of economic interdependencies among firms or macro-economic relationships have been disposed of by an implicit assumption. The macro

[4] Kenneth E. Boulding, *Economic Analysis* (Revised edition), Harper and Brothers, New York (1948), p. 477. A similar statement may be found in Earl O. Heady, *Economics of Agricultural Production and Resource Use*, Prentice-Hall, New York (1952), p. 672; and in Paul A. Samuelson, *Economics An Introductory Analysis* (First edition), McGraw-Hill, New York (1948), p. 508.

supply could be determined by merely adding the supply schedules of all firms only when external interdependencies have been taken into account in the determination of all individual supply schedules. For one to assume that external interdependencies have been taken into account and to proceed by adding the supply schedules of individual firms appears to oversimplify the problem of the *economics* of aggregates by assuming away that which is to be determined.

Part of the problem may be illustrated with a diagram. Let us imagine that any farmer's *ex ante* supply schedule of any product or aggregate of products is of the general character described by the curve ss in Figure 1. This function is derived from the farmer's cost function taken with possible product prices, when there are no changes anticipated in factor supply as faced by the farmer. Continuous demand and output conditions faced by the firm are not necessary for the analysis. Actual conditions of these variables depend upon the character of the particular problem. Currently, the farmer is producing at the rate of q_1 and is receiving price P_1. At least after some particular point one would expect the supply function to rise at an increasing rate with respect to larger quantities because of decreasing marginal physical productivity and/or a higher price of funds for operation.

Now suppose that this farmer expects price to rise to P_2. He will plan to expand output to q_2. But isn't it reasonable to believe that a large number of quite similar farmers would attempt similar plans, especially if, as is likely to be true, the rise in price of this commodity is accompanied by a rise in price of many other commodities in the production of which the same factors might be employed. Such conditions give rise to increases in factor prices and our farmer now actually finds his most profitable output at Q_2. The opposite reaction would be true when product price decreases. In place of no change in factor prices and a most profitable output at q_3, the farmer facing lower factor prices would actually produce Q_3. The SS functions would be additive whereas the ss functions would not be additive. This particular macro problem would be to determine the character of the SS function. The SS function is not a supply function under ceteris paribus conditions. In fact, it appears that such a concept for macro-supply would be unreasonable. It is hardly possible for price and quantity of any product in the aggregate to change appreciably without changes in size and distribution of income and in prices and quantities of other commodities. For example, if output of corn were reduced by 10 per cent, what changes would occur in corn prices, in the production and prices of commodities that in use might be substituted for corn; and in production and prices of those commodities that might be produced with the resources removed from corn production?

The supply of land, family labor, and capital funds faced by the farmer

is likely to be inelastic in any one and often more periods of production.[5] Prices of land, family labor, and other assets under fee-simple ownership and under share rental arrangements are likely to decline immediately with any reduction in expected income. These conditions shift the farm's supply function from ss to SS when expected prices fall below p_1 as depicted in Figure 1. A considerable part of the apparent lag of changes in factor prices, especially land and labor, behind changes in product prices are likely a result of inaccurate observation. When price observations depend upon actual market reports, the observations are not likely to reflect immediately the changes in real supply price of factors that are not purchased frequently in the market. Such factors include the assets owned by the entrepreneur's household and the resources held by means of a share agreement.

Finally, recognition of the fact that many persons in the market at least apparently have "tasted the apple of knowledge" has led to inquiries into likely economic and political behavior under conditions of external interdependency recognized. In this category one might place some of the studies of national policies and programs of agriculture, industrial pricing and output policies, labor policies and programs, and the theories of games applied to economic phenomena. Such inquiries as those listed above in addition to further study of political, economic, and social implications of the locus of the decision making processes are needed in order that private and public decisions may be consistent with objectives. Furthermore, it is believed that such research would provide relevant knowledge for solving those problems that involve conflicts of economic interest. In such problems interdependencies among rate of flow and personal distribution of income and institutional arrangements are no longer "given" but are to be determined.

W. W. MCPHERSON

North Carolina State College

[5] See D. Gale Johnson, "The Nature of the Supply Function for Agricultural Products," *American Economic Review*, XL, September, 1950, pp. 539-564.

ACCURACY OF IOWA FARM OUTLOOK INFORMATION*

JOHN D. BAKER, JR., and Don Paarlberg have reported in *This Journal* the results of an evaluation of the accuracy of economic forecasts made by the Bureau of Agricultural Economics. Using the method

* Journal Paper No. *J-2408* of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. *1031*. This summary is based on a part of the author's Iowa State College M.S. thesis in Technical Journalism, *Directional Accuracy of Farm Price Predictions Published in the Iowa Farm Outlook Letter (July 1, 1948, to July 1, 1951)*. No attempt has been made to duplicate the detailed documentation contained in the footnotes of the original thesis.

described in their report, Baker and Paarlberg found that price forecasting accuracy was much lower than was the accuracy for forecasts in series partly or largely outside the price field; forecasts of prices received by farmers had a score of 60, while the other three series examined, forecasts of industrial production, demand, and farm income, all had scores of 77 and 78.[1]

With certain adaptations, the evaluation method reported by Baker and Paarlberg has been used to evaluate the accuracy of farm price predictions published in the *Iowa Farm Outlook Letter* from July 1, 1948, to July 1, 1951. During this time, three volumes of the weekly mimeographed *Letter* for farmers were published. This *Letter* is more often concerned with longer term predictions. The length of term of the predictions used by Baker and used from the *Letter* are of the same general types and lengths.

The Iowa Agricultural Extension Service has published the *Iowa Farm Outlook Letter* and its predecessors for many years. The purpose has been to help farmers formulate more accurate price expectations by publishing statements of general and specific economic conditions and by publishing predictions of probable demand, supply and price expectations. Such information does not enable the farmer to formulate price expectations that are unerringly accurate, but, if the use of public funds for this purpose is to be justified, outlook predictions should at least be more accurate than the accuracy a farmer could achieve by guessing. That is, outlook information should give the farmer a better than fifty-fifty chance of making the correct decision as to the probable direction of farm price changes about which predictions are published. Individual farm operators, of course, might achieve either a higher or lower batting average than 50 in formulating their own price expectations through making their own observation and analysis of the situation.

All predictions relating to prices either directly paid or received by farmers published in the *Letter* over the three-year period were evaluated basically according to the method used to evaluate the federal forecasts and as outlined briefly in *This Journal* by Baker and Paarlberg.[2] In the Iowa evaluation, however, the procedure used to classify actual outcomes as to "increases," "decreases," or "stabilities" differed from that used for the federal forecasts. In that evaluation, an array of the actual per cent changes taking place from one period to the next in the series data over the time under consideration was used in determining the classification of outcomes; the upper one-third of the array was called an "increase," the lower one-third a "decrease," and the middle one-third "stability."

[1] John D. Baker, Jr. and Don Paarlberg "How Accurate Is Outlook?" *This Journal*, November, 1952, pp. 509-519.

[2] *Ibid.* pp. 509-510.

(Some earlier evaluations of outlook information avoided this more difficult classification problem by calling any increase an increase, any decrease a decrease, and by limiting stability to no change at all.)

Neither of these two possible procedures seemed satisfactory for the Iowa evaluation where it was desired (1) to take the view of the farm operator receiving the *Iowa Farm Outlook Letter* and (2) to develop or adapt a procedure that could be used relatively easily and quickly to evaluate the accuracy of outlook material published in the *Letter* or otherwise disseminated by Iowa State College in past or future periods. A procedure in which the definition of stability permitted no change whatsoever in the actual outcome seemed too strict to optain a practical or realistic evaluation. The procedure reported by Baker and Paarlberg was relatively broad and seemed equally unsatisfactory for the purpose intended.[3]

The Iowa evaluation attempted to take the view of the farmer-recipient of the *Letter*. It is doubtful if he, reading the statement, "Corn prices should remain about the same . . . ," would expect that there would be no change at all. Neither is it possible for him, upon receipt of the *Letter*, to have an array of the changes which will occur (but have not yet occurred) and be able to view the various segments of this yet non-existent array as increases, decreases, and stabilities.

For these and other reasons, it was decided to define "stability" as a change of anything less than 5 per cent (including no change) in either direction from the base figure used. It was believed that this definition (giving stability a range of approximately 10 per cent of the base figure) would be reasonably close to what a reader of the *Letter* might expect from a statement to the effect that a given price should remain about the same. (The base figure or price was considered to be the current price at the time the prediction was made or such other price or figure that the prediction indicated it was predicated upon.) An increase, then, was an increase of 5 per cent or more over the base figure used; a decrease was a decrease of 5 per cent or more under the base figure used; and stability was any change of less than 5 per cent in either direction from the base figure.

With the exception of the method used in classifying outcomes, the remainder of the entire procedure used in the Iowa evaluation was substantially the same as that used for the federal evaluation. (In both evaluations, the average change per unit of time, rather than isolated, specific

[3] Technical objections are not being offered to either of the procedures. There is nothing necessarily "wrong" or "bad" with either; one is quite strict, the other quite broad even though it presumably resulted in classifications relative to the variability of each series examined. The procedure might best depend upon the purpose for which the evaluation is to be used, though, for purposes of comparison with other evaluations, some uniform procedure might be desirable.

high or low variations or the change or value at the end of the time pattern, was used to check the accuracy of each prediction.)

Results

Based on the scoring system reported by Baker and Paarlberg whereby 50 represented the accuracy score which would be obtained by guessing or by making random forecasts over a long period of time, the accuracy score for all farm price predictions published in the *Iowa Farm Outlook Letter* during the three-year period was 74.6. The score for the period July 1, 1948, to July 1, 1949, was 70.8; for 1949-50, 71.3; and for 1950-51, 81.8. Although the evaluation of federal economic forecasts was for a much longer time and used different limits in classifying actual outcomes as to increases, decreases, or stabilities, the federal accuracy score of 60 for predictions of prices received by farmers may be compared, but only roughly, with the three-year Iowa score of 74.6 for predictions of prices both paid and received by farmers. It should be obvious, however, that this comparison alone should not be interpreted as indicating that the Iowa score would have been either higher or lower than the federal score taken over the same time period. In addition to the differences already noted, factors such as differences in items covered, differences in lengths of predictions, etc. increase the difficulty of making a direct comparison.

Accuracy scores for specific types of price predictions published in the *Letter* during the three-year period were: Hogs, 73.5; Beef Cattle, 73.1; Grain, 71.9; Poultry and Eggs, 66.7; Dairy, 83.3; General Farm Price Level, 86.5; and Other, 86.1. As an indication of emphasis only, it was interesting to note that the number of Iowa predictions made for different items (hogs, beef cattle, grain, etc.) corresponded roughly in proportion to the proportions of Iowa gross farm income derived from sales of each during the three-year period.

As was true for the federal forecasts evaluated, Iowa forecasts of decreases were less accurate than forecasts of increases. The Iowa score for forecasts of decreases was 70.7; for stabilities, 71.9; and for increases, 81.2. The corresponding federal scores were 52, 66, and 89.

More Evaluations Needed

With the federal government, many state land-grant colleges, and commercial organizations actively engaged in various "outlook" activities, it is somewhat surprising that relatively little formal evaluation of the accuracy of outlook information has been attempted or made available.

One of the factors contributing to the lack of more formal evaluations of the accuracy of outlook information may well be the difficulty in measuring the accuracy. That is, most outlook predictions are made in terms of

direction only, rather than in definite numerical terms. Thus, the more precise mathematical and statistical measures cannot readily be applied. Should the predictions themselves became more exact, more precise measures could be applied.

On the other hand, evaluations such as those mentioned here should be useful to those concerned with the preparation and dissemination of outlook material in appraising and improving their work—and of interest to farmers in giving them some indication of the degree of confidence they may place in outlook information.

JOHN F. HEER

Iowa State College

COMPARATIVE PRECISION OF ALTERNATIVE SAMPLING DESIGNS FOR FARM MANAGEMENT AND LAND ECONOMIC SURVEYS

THIS is an expansion on one section of a report previously made in *This Journal* on an experimental sampling project being conducted at Cornell University.[1] The intent here is to present the results of comparisons in precision between selected sampling designs more completely than was done previously. Results for one additional design, systematically selected individual farms, also has been added to the previous discussion.

Measures of precision presented here are based upon the actual sampling variability gotten by repeatedly drawing samples of various kinds from a known universe of real farms. The universe consisted of 556 full-time commercial farms in Seneca County, New York, on which records previously had been obtained—an 85 percent coverage of all farms actually meeting the definition of a full-time commercial farm in this county.[2] Three farm-business characteristics are treated here, total acres operated, acres in crops, and size of business in productive-man-work units.

Seneca County is in the general farming area of the state where dairying

[1] Q. M. West, "Some Alternative Sampling Techniques in the Measurement of Farm-Business Characteristics," *This Journal*, December 1952, page 982. It also summarizes some materials contained in: Q. M. West, *The Results of Applying A Simple Random Sampling Process to Farm Mangement Data*, Cornell University, Dept. of Agr. Econ., A.E. 743, 1951.

[2] The definition of a full-time commercial farm required a minimum of 11.5 months of adult male time for farm work and at least 100 productive-man-work units.

The 15 per cent not included in the survey consisted of farms on which the operator had changed in the past year, farmers who could not be contacted at the time of the survey, and a few refusals. It is believed that omission of this 15 per cent does not materially bias the survey measurements. In any case the coverage corresponds to what is ordinarily considered satisfactory in most field surveys of this kind.

and cash crop production is combined. General knowledge indicates Seneca County to be reasonably representative of the Central Plains region of the state, an area extending from Syracuse to Buffalo with its southern boundary marked by the higher elevations of the Plateau Country.

Seven different sample designs were investigated. Two of these involved selecting farms individually; in one instance at random and in the other according to geographically systematic patterns. Random selections were made through the use of random number cards and an IBM collator. The systematic sampling was done by listing the farms according to the sequences in which they occurred along various serpentine paths through the county. Twenty paths were laid out using various starting points and various travel patterns in "visiting" each of the farms. Five possible samples could be chosen from the ordered list for each path at the sampling rates used in this study. All five possible samples for each ordering were used in the phase of the study here reported. (Thus, with twenty orderings, a total of one hundred samples were gotten.)

Five of the sample designs involved area segments as sampling units, these segments being geographically contiguous groups of farms. Selections were made from these geographic segments in the segment sampling designs, the farms within the chosen units in each case constituting the sample.

Segments of three different sizes were used. For two designs the segments averaged 3.14 farms each, but the actual number varied from one segment to another. In a third design the segments averaged 6.25 farms each and again varied from segment to segment. The fourth design employed segments in which farm numbers were held constant at three farms per segment.

Four of the segmented designs involved random selections, again using random number cards, and a fifth employed systematic selections. The ordering of segments for systematic selection was carried out in the same manner as the ordering of individual farms in the individual systematic design, and sample selections were made in a similar manner.

An historical tendency in some farm management quarters to get a fixed predetermined number of records, commonly 100, prompted the use of two segmented designs in which a fixed number of farms was chosen for each sample. In the other segmented designs, sample size was set in terms of the number of segments to be chosen. This resulted in a variable number of farms per sample except where the number of farms per segment was a constant. The various kinds of sample designs are listed in brief in the first column of Table 1, with sample sizes in the second column of this table.

One hundred samples were drawn for each of the different sampling

designs and all samples contained exactly, or very nearly, 100 farms. Samples were taken without replacement, as is usual in most survey studies. Several statistics were computed for each of the samples, including means, medians and variances. Attention is confined in this article, however, to the sampling variability of means.

TABLE 1. STANDARD DEVIATIONS OF 100 EXPERIMENTAL SAMPLE MEANS, SEVEN SAMPLING DESIGNS, THREE FARM-BUSINESS CHARACTERISTICS, SENECA COUNTY, NEW YORK

Sampling design	Average number of farms per sample	Total acres operated	Acres in crops	Productive-man-work units
		Standard deviations		
Individual random	100	9.78	6.37	28.72
First segmented random (avg. of 3.14 farms per segment, 33 segments per sample)	104	11.30	7.27	26.18
Second segmented random (avg. of 3.14 farms per segment, 100 farms per sample)	100	11.76	8.40	30.83
Third segmented random (avg. of 6.25 farms per segment, 100 farms per sample)	100	11.65	7.73	30.47
Fourth segmented random (3 farms per segment, 33 segments per sample)	99	10.44	7.13	28.64
Segmented systematic (3 farms per segment)[a]	111	9.64	6.14	30.44
	100[b]	10.16	6.47	32.07
Individual systematic[a]	111	8.35	4.90	22.47
	100[b]	8.81	5.18	23.67

[a] Computed from averages of variances for twenty distributions of five sample means adjusted for degrees of freedom.

[b] These figures have been estimated from the corresponding figures for systematic samples of 111 on the basis of experimental evidence not discussed in this paper. They are presented to facilitate comparisons among the designs.

The means of the 100 sample means gotten for each of the seven sampling designs very closely approximated the corresponding universe means for the three characteristics under consideration here. The frequency distributions of sample means in all but a few cases also closely approximated normal distributions.[3]

[3] See publications cited above and: Q. M. West, *Some Alternative Sampling Techniques in the Measurement of Farm-Business Characteristics*, Cornell University, Ph.D. thesis, 1951.

Table 1 presents standard deviations for the 100 sample means gotten with each sampling design for the three characteristics, total acres operated, acres in crops, and productive-man-work units. Table 2 presents these standard deviations as percentages of corresponding universe means.

While the differences among designs in Tables 1 and 2 are not great,

TABLE 2. COEFFICIENTS OF VARIABILITY FOR 100 EXPERIMENTAL SAMPLE MEANS, SEVEN SAMPLING DESIGNS, THREE FARM-BUSINESS CHARACTERISTICS, SENECA COUNTY, NEW YORK[a]

Sampling design	Average number of farms per sample	Total acres operated	Acres in crops	Productive-man-work units
		Coefficients of variability		
Individual random	100	5.64	6.57	6.89
First segmented random (avg. of 3.14 farms per segment, 33 segments per sample)	104	6.46	7.44	6.28
Second segmented random (avg. of 3.14 farms per segment, 100 farms per sample)	100	6.73	8.60	7.39
Third segmented random (avg. of 6.25 farms per segment, 100 farms per sample)	100	6.66	7.91	7.31
Fourth segmented random (3 farms per segment, 33 segments per sample)	99	5.97	7.30	6.87
Segmented systematic (3 farms per	111	5.51	6.28	7.30
per segment)	100	5.81	6.62	7.69
Individual systematic	111	4.78	5.02	5.39
	100	5.04	5.30	5.68

[a] These values were obtained by dividing the figures of table 1 by the respective universe means.

they do, nevertheless, follow in general what might have been expected. For the most part, segmentation caused a loss of precision, although the increase in segment size used in this experiment did not further reduce precision as might have been expected. Systematic sampling introduced rather clear-cut gains in both cases in which it was used with one conspicuous exception, segmented systematic samples considered in terms of productive-man-work units. In general, segmented systematic samples approached the precision of individual random samples and segmented individual samples showed definite gains over all other sampling methods.

Table 3 pictures the differences among sampling designs more strikingly. The figures of this table represent estimates of the sizes of samples

needed by the various sampling methods to attain a degree of precision equal under these circumstances to the precision of an individual random sample of 100 farms. These estimates are based upon the variances of sample means. The differences in this table thus are essentially the differences of Table 1 magnified by a squaring process.

TABLE 3. SAMPLE SIZES NEEDED BY ALTERNATIVE SAMPLING DESIGNS TO ATTAIN THE PRECISION OF A ONE-HUNDRED-FARM INDIVIDUAL RANDOM SAMPLE, THREE FARM-BUSINESS CHARACTERISTICS, SENECA COUNTY, NEW YORK

Sampling design	Total acres operated	Acres in crops	Productive-man-work units
	Number of farms per sample		
Individual random	100	100	100
First segmented random (avg. of 3.14 farms per segment)	133	130	83
Second segmented random (avg. of 3.14 farms per segment)	144	173	115
Third segmented random (avg. of 6.25 farms per segment)	142	147	113
Fourth segmented random (3 farms per segment)	114	125	99
Segmented systematic (3 farms per segment)	108	103	125
Individual systematic	81	66	68

The estimates of Table 3 are, however, directly understandable in terms of everyday sampling experience. Thus, for example, this evidence indicates that to estimate with equal precision the universe mean for acres in crops by the second segmented random design requires over twice as many records as to estimate this value with an individual systematic sample. Other comparisons that can be made within this table reveal differences that are similar in direction, though different in magnitude, from those of the previous tables.

It should be pointed out that the figures of Table 3 have been computed on the assumption that precision varies with size of sample for all of the designs in the same manner that it varies with size for simple random samples. Information from another phase of this study suggests that this is true for individual systematic samples, but no experimental evidence on this point has been obtained for the other designs.

A possible tendency to jump quickly to conclusions on the basis of the great differences in Table 3 is tempered by the results of tests for the

significance of the differences in precision among the various designs.[4] By these tests, the seven sample designs were found to differ significantly only in the following combinations for the respective characteristics (combinations bearing an asterisk differed significantly at the one per cent level; others differed at the five per cent level):

Acres operated

Individual random—second segmented random.
Individual random—third segmented random.
First segmented random—individual systematic.*
Second segmented random—individual systematic.*
Third segmented random—individual systematic.*
Fourth segmented random—individual systematic.

Acres in crops

Individual random—second segmented random.*
Individual random—third segmented random.
Individual random—individual systematic.
First segmented random—individual systematic.*
Second segmented random—fourth segmented random.
Second segmented random—segmented systematic.*
Second segmented random—individual systematic.*
Third segmented random—segmented systematic.
Third segmented random—individual systematic.*
Fourth segmented random—individual systematic.*
Segmented systematic—individual systematic.

Productive-man-work units

Individual random—individual systematic.
First segmented random—second segmented random.
First segmented random—segmented systematic.
Second segmented random—individual systematic.*
Third segmented random—individual systematic.*
Fourth segmented random—individual systematic.
Segmented systematic—individual systematic.*

The segmented random samples differ among themselves with statistical significance in only two instances and then only at the 5 per cent level.

[4] Inasmuch as the sample means for nearly all designs were distributed in ways that did not differ significantly from the normal, statistical tests for significance give particularly meaningful evidence in this instance. Variance ratios and tables of F were used in making these tests. See: W. J. Dixon, and F. J. Massey, *Introduction to Statistical Analysis*, McGraw-Hill, 1951, pp. 88-90. A one-sided test was used here, with variance ratios set up in each case to be greater than one.

They differed significantly from individual random samples in only four instances out of a possible twelve, and in three of these the difference was only at the five per cent level. The consistency with which the segmented samples show lower precision than individual samples still supports, of course, the idea that segmentation causes a loss of precision.

Individual systematic sampling receives strong support from these tests of significance. These samples differ significantly in fifteen out of a possible eighteen instances, and in ten instances differences are significant at the one per cent level. The systematic sampling of segments, on the other hand, does not appear, on the basis of these tests, to offer comparable gains in precision. Segmented systematic samples differed significantly from other segmented samples in only three instances, and in one of these instances the precision of the segmented systematic sample was lower than for the random sample. The fact, however, that segmented systematic samples did not differ significantly from individual random samples for any of the three characteristics does support the idea that gains from systematic sampling tend to overcome the losses from segmentation.

QUENTIN M. WEST AND HOWARD E. CONKLIN

Instituto Interamericano de Ciencias Agricolas and Cornell University

A PLAN FOR SAMPLING A CHANGING POPULATION OVER TIME*

THE necessity of obtaining a series of related data with some continuity through time is common to a number of fields of empirical investigation. When such data are obtained from a sample of consumers who report periodically the sample is usually referred to as a consumer panel. Other similar types of samples or "panels" are involved in many of the farm account record projects, the collection of many of our business statistics from individual firms, the current census of employment, and some radio listening and public opinion studies.

Every sampling problem involves decisions concerning: (1) the definition of the universe and units of observation; (2) determination of the size of the sample; and (3) the development of the sampling procedure including the special restrictions on the design and the technique for

* Journal Article No. 1415, Michigan Agricultural Experiment Station. This paper is adapted from the author's Ph.D. Thesis, "Methodological Bases for the Operation of a Consumer Purchase Panel," written under the direction of Dr. G. G. Quackenbush, of the Department of Agricultural Economics, of Michigan State College.

handling non-respondents. Essentially the same decisions have to be made when designing a panel sample as are required in designing any other sample. However, in the case of the panel sample, there are certain peculiarities which make some modifications in the usual procedures desirable or necessary because the panel sample must be maintained through time. In addition, because of the requirements on the respondents' time and effort, the non-response problem is much greater than for the usual one-time survey.

While this discussion is strictly limited to a brief outline of the *special considerations* involved in panel sampling and to the presentation of *a* sample design for a consumer purchase panel, it is hoped that it will contribute to the development of a more complete sampling methodology in general. At the very least it provides in some detail an example of a panel sampling plan designed to be representative of a changing and not fully cooperative population, which is something the author did not find when first faced with the problem of establishing such a panel.

Defining the Universe and Units of Observation

In establishing the geographic limits of a panel sample at least one factor must be taken into consideration beyond those involved in one-time surveys. A geographic definition which describes an area of interest today may not describe the same area years later. A local consumer panel involves a difficult problem in this respect. Cities, metropolitan areas, or marketing areas change their geographic boundaries through time. A panel defined as representing such an area through time should, therefore, include procedures for adjusting the geographic sample limits to these changes.

In defining the unit of observation for the panel recognition should be given to the fact that the unit itself will change through time. Thus, if the family is the unit of observation, one must decide what constitutes the creation of a new unit, when a unit ceases to exist and whether or not the family is the same unit when members are added or subtracted, etc.

Determining the Size of Sample

All of the factors which must be considered in determining the sample size in a single survey must also be considered in determining the optimum size of the panel sample. However, in comparison to a single survey, the cost structure is quite different for a panel and the frequency of purchase of some items may influence the optimum size. The panel sample, because repetitive records are obtained from essentially the same households, eliminates one of the possible sources of sample error compared to successive one time surveys based upon different samples.

The Non-Response Problem

All sample surveys have a non-response problem. The panel has essentially three non-response problems: (1) The problem of making an initial contact (How many calls should be made to an address before giving up?); (2) The problem of non-cooperation from those who are contacted; and (3) The failure of those who do agree to become panel members to send in some of the diaries.

TABLE 1. A FREQUENCY DISTRIBUTION OF THE NUMBER OF CALLS MADE IN RECRUITING 262 MEMBERS TO THE MSC CONSUMERS PANEL[a]

Number of Calls	For Cooperators	For Refusals	For Drops
1	121	75	34
2	70	54	29
3	29	29	22
4	23	13	5
5	8	8	1
6	7	1	3
7	0	5	0
8	1	0	2
9	3	0	0
10	0	1	0
Total	262	186	96
Cumulative Total	557	413	217

[a] Includes only recruitment calls. It does not include training calls or follow-up calls to those who dropped.

Table 1 shows a frequency distribution of the number of calls made in recruiting 262 members to the MSC Consumer Panel and indicates the magnitude of the problem. A total of 1,187 calls were required to recruit only 262 panel members. Here again, it should be kept in mind that the panel can afford to spend more in making the contacts, if this increases the sample accuracy, than in the case of the one-time surveys. However, one might question the value of making more than six attempts before giving up the quest, in view of the record shown in Table 1. The 96 calls, required to make contact with 12 households requiring more than six calls each, netted only four panel members.

Two much more important non-response problems for the panel are the large number of families contacted who refuse to become panel members and those who agree to join the panel and then do not send in the diaries. Table 2 shows the number of diaries sent in by each of the first 96 panel members to drop from the MSC Consumer Panel. It will be noted that almost 50 percent of those "dropping" did not send in a single diary while 90 percent sent in less than nine diaries before dropping. Most panels report a mortality rate above 25 percent during the first two or

three reporting periods. Many of those returning more than eight diaries before dropping had good reasons for not continuing, such as moving out of town, serious illness and the like.

A special study of "panel cooperativeness" was made in the process of recruiting the MSC Consumer Panel. The initial sample was selected in a random manner and each family selected was subsequently called upon by a personal interviewer. An analysis was then made of the difference between those cooperating and those not cooperating. This study revealed that the cooperators were substantially different from the non-

TABLE 2. NUMBER OF WEEKS REPORTING BEFORE DISCONTINUING PANEL MEMBERSHIP FOR FAMILIES DROPPING FROM MSC PANEL AS OF SEPT. 10, 1951

Number of Diaries Returned	Number of Families That Returned Designated Number	Cumulative Per Cent
0	45	47
1	11	58
2	9	68
3	2	70
4	2	72
5	9	81
7	6	88
8	2	90
9	4	94
10	1	95
13	1	96
15	1	97
17	1	98
19	1	99
20	1	100
—	—	—
	96	

cooperators in respect to the following characteristics: (1) education of the homemaker (only 39% of the homemakers with 8th grade or less education cooperated as compared with 65% of those with one or more years of college); (2) disposable family income (25% more of the middle income group cooperated than for the high or low income groups); (3) type of family (the "unusual" type such as those with one or the other of the parents missing or those with members outside of the immediate family were less cooperative than the "typical family" type); (4) age of homemaker (homemakers over 65 were least cooperative); (5) number of family members employed (those with more than one employed were less likely to join the panel); (6) race; (7) use of home canned food; (8) keeping of household accounts.

In respect to rates of consumption of many foods however, the cooperators proved to provide a very close approximation to that obtained for the total sample. This was based upon a cooperation rate of about 50%

and is apparently due to the fact that the non-cooperators tend to be those at opposite extremes and thus tend to cancel out in terms of consumption.

However, since the types of families which are hard to recruit are also most difficult to maintain as good panel cooperators, an uncontrolled sample would tend to become more biased as time passed.

Panel cooperativeness is definitely not randomly distributed within the population. A sampling technique must therefore be adopted which recognizes this fact.

Keeping the Panel Representative

This is a problem which in itself is peculiar to panel sampling. The following facts must be considered. It appears that a mature continuous-reporting consumer purchase panel can expect from 10 to 15 percent mortality or turnover per year. A system must be devised for replacing those families who drop out. People move, die, leave home, get married, have children, change jobs, and change in many ways, any of which changes the composition of the households in the panel sample, and therefore, the panel sample itself. The population which the panel sample once represented is undergoing similar changes.

It must be decided whether the panel sample is to be dynamic—kept continuously representative of a dynamic population—or static—kept representative of a population as it once existed; member centered, where the reporting is from exactly the same families with no attempt made to keep the sample representative of any population; or some combination of these. This decision will be based primarily on the objectives of the panel study.

The high cost of operating a consumer purchase panel often makes it necessary, or at least desirable, to use the panel for a number of purposes. For this reason it may be desirable to design a panel sample with the characteristics of all three types of panels. It is possible to have both types of static samples within a dynamic sample but not usually possible to construct a dynamic sample from a static sample. Too little attention has been paid to this aspect of panel sampling, since keeping the panel sample representative of the dynamic population is one of the most important considerations in respect to the types of problems which many panels are designed to solve. This obviously must be given a high priority in the development of any panel sampling methodology.

A Suggested Sampling Procedure

The problem of the sampling procedure for a consumer purchase panel boils down to this: (1) how to obtain an initial sample of panel cooperators which is representative of the total population and (2) how to keep

the panel sample continuously representative of the dynamic population. The procedure suggested here is believed to be an acceptable and workable solution. The procedure suggested is essentially that used for the MSC Consumer Panel now operating at Michigan State College.

The first step in the procedure is that of taking a sample census of the population under consideration. The applications and uses of the sample census include the following: (1) It forms the basis for establishing desired quotas with greater precision than would be possible from a panel-size sample. (2) It provides an unbiased list of prospective panel members and identifies these families in respect to characteristics and address. (3) It establishes a prior contact with prospective panel members and helps to establish rapport. (4) It makes possible an evaluation of the final panel sample for comparison. (5) It makes possible a number of complementary studies. (6) It provides a source of information for further development of panel sampling methodology.

Obtaining a Representative Sample—The First Sample.—The second step toward obtaining a representative sample, following the taking of a sample census, is to draw the first sample of prospective panel members from the list of families obtained from the sample census.[1]

In establishing a panel at Michigan State College, four factors were used as controls in the selection of the families to be included in the first panel sample: (1) income (divided into four groups); (2) education of the homemaker; (3) age of homemaker; and (4) number of persons in the household. After the control factors and the size of the sample were decided upon, the families (on punch cards) were serialized by code numbers thus putting them in a random arrangement and then serialized on the four control factors.[2] This arranged the families (or cards) by income, education of the homemaker, age of homemaker, and size of family.

Proportionate representation was obtained by use of a stratified systematic sample (selection of every Nth card or family from the deck of cards so arranged). This insured that within each income group a proportionate number of families with each of the other control factor characteristics would be included in the sample.

Alternates.—The fact that every family will not cooperate in a panel survey makes it necessary to determine a course of action in respect to the non-cooperators in the sampling process. There are two primary directions in which to go. (1) The non-cooperators may be disregarded. This assumes that the non-cooperators are not greatly different than the

---

[1] The use of punched cards and automatic sorting and tabulation equipment may prove to be advantageous in making the selections. By having the characteristics of each family coded and punched into a card the families may be grouped in any way desired.

[2] By sorting the cards first on the column in which size of family was coded, then age of homemaker, education, and finally, income.

average for the cooperators. (2) The non-cooperators may be substituted with families with similar characteristics. This assumes that families with similar characteristics are more alike than the non-cooperators are like the average of the cooperators. This latter assumption appears to be the more valid and is the one upon which the following sampling procedure is based.

There are several alternative methods by which substitutes or alternates may be selected. The most common method, used extensivly in making one-time surveys where a limited number of call backs are used, is simply to select the "next" address. This assumes that neighbors are similar in characteristics and behavior. It should be recognized that this is essentially quota substitution based upon one control—that of geographic location. The former Industrial Surveys Company, now the Marketing Research Corporation of America, has worked out a complicated variation of this procedure introducing additional control factors in order to determine which of four neighbors would prove to be the best substitute (i.e., the family most similar to the non-cooperator).[3]

Restricting the selection of a substitute to families living in close proximity to the non-cooperating family would appear to restrict the possibility of duplicating the characteristics of the original sample. The procedure suggested here for the selection of alternates involves the use of a number of controls and is not restricted as to geographic area.

The primary consideration in determining the control factors to be used in stratifying for the first sample was the effect that a disproportionate representation of the different possible control factors would have on the final analysis. The four controls selected were chosen because of their importance as factors related to the consumption of food. It was not necessary to consider the factors most affected by non-cooperation. However, the system of controls established for the purpose of guiding the selection of alternates must also consider the factors most affected by non-cooperation. Therefore, in the selection of substitutes, the following controls were added to the original four used in stratifying the first sample: (1) income broken into 12 classifications, (2) food bill, (3) race, (4) occupation, (5) whether or not the homemaker does her own canning of fruits and vegetables, (6) whether or not homemaker has kept household accounts, (7) employment of members of the household other than the head of the family, and finally, (8) the place of birth of the homemaker. The 12 controls were used to guide the selection of substitutes in such a way that the final sample of panel cooperators will have the same general pattern of

---

[3] Stanley Womer, Resume of Methodological Projects, under contract No. A-15-32654, Mimeograph 1951, page 10. See Market Research Reports 8 and 40 for further information on panel methodology developed by this prominent survey organization.

distribution of these 12 characteristics as existed in the sample census.

The mechanics of selection involves the establishment of quotas for each factor within income groups. The process is somewhat simplified by arranging the punched cards in serial order on all of the control factors, by sorting them in reverse order, and then listing the families in order on a tabulation sheet. This puts all those families with the same characteristics together making it possible to select at random from those with the proper characteristics. As far as possible replacements are selected so as to represent the sample census in respect to combination of characteristics rather than simply setting a quota for each characteristic individually.

Maintaining a Representative Sample.—Obtaining an initial panel sample representative of the population as it existed at the time the sample census was taken is only part of the panel sampling problem. The panel must be maintained representative through time. Actually if the panel is not recruited the same day the sample census is taken, some changes in the population will take place between the time of the sample census and the time and panel is recruited, and it is therefore necessary to "bring the sample up to date" even before the panel is fully recruited. A program designed to maintain a representative panel sample must therefore include methods for accomplishing three objectives—viz., to bring the panel sample up to date in such a manner that it is currently representative of the population; to keep the panel sample representative of the changing population; to replace those who drop from the panel sample with other households in such a way that the representativeness of the panel is not disturbed. The method devised to accomplish these three objectives requires the definition and use of three different samples.

The First Sample.—The first sample has already been discussed. It is simply the first group of households selected from the sample census to be recruited as panel members. It includes both cooperators and non-cooperators. If there were no changes in the population and all selected households cooperated, the first sample would be identical with the active panel sample. In this discussion the first sample is considered to be proportionately representative of the total population as measured by the sample census.

The Basic Panel Sample.—The basic panel sample consists of those households selected from the sample census which agree to become active panel members and act accordingly. This includes those households selected in the first sample and those subsequently selected as replacements for those of the first sample who refuse to become panel members or who are dropped from the panel. The basic panel sample does not include any household not originally in the sample census nor any household which fails to cooperate or drops from the panel.

This basic sample is essentially static in nature. It is to be kept at a

constant size and representative of the population existing at the time of the sample census. It is the basic sample in that it serves as the basic link between the sample census and the active panel sample. This sample is established and maintained through the quota sampling technique discussed in the previous section, and is the basis for replacement of most of the non-cooperators.

The Active Panel Sample.—The active panel sample consists of the households actually reporting as panel members. It is the *panel* and is composed of the following: (1) all households of the basic panel sample currently existing in the sample area (this excludes all those households which no longer exist or which have moved outside the sample area); (2) a representative sample of households moving into the area; and (3) a representative sample of the newly created families generated from within the sample area. By including these households, the panel is maintained representative of the total population of the sample area at all times. The method by which this may be accomplished is discussed in the following paragraphs.

Compensating for migration induced changes in the population.—If the panel is to be maintained representative of the population of a particular area over a period of time, it must reflect the movement of population to and from the area. This may be accomplished by following the movement of panel households and checking the households moving to addresses vacated by panel members. Thus, if a panel household moves from its original address it is maintained as a panel member if it moves to a new address within the sample area. If it moves out of the area it is dropped from the active panel. In each case an interview is obtained from the household which has moved to the address vacated by a panel household. The household moving into the vacated address is added to the active panel if it has moved in from outside the panel area, otherwise it is simply added to the panel pool.[4] The same rule would be followed where two or more families moved into a housing unit previously occupied by a panel member. If from outside the sample area, the household would be added to the active panel. But, if a panel family moves in with a previously established family of the sample area, it is to be dropped from the panel in order to reflect the change in the number of households in the area.

This procedure, however, misses one type of family involved in migration—the families moving into the area directly into newly constructed residences. In order to reflect the changes in the population caused by this migration, special surveys may be taken periodically of the newly constructed housing units. The addresses to be interviewed would be

[4] The panel pool is simply a list of households with known characteristics but not used as panel members. It may be used for a number of purposes.

selected in the same ratio as the panel is to the total population and all those contacted which had moved into the new units directly from outside the sample area would be recruited to active panel membership.[5] In these ways the immigration to the sample area is balanced against the emigration from the area in such a way that the panel sample reflects the net change in the total population.

Reflecting internal changes in the population.—Assuming that the panel sample is representative in the beginning, the non-migrant part of the panel sample should reflect the changes in the non-migrant population of the sample area. Continuing cooperation from the panel members is the primary requisite for the accurate reflection of change. However, simply maintaining the non-migrant panel members in the panel will not reflect the changes in the number of households in the area and the resultant change in the population characteristics induced by internal change. In order to properly reflect these changes a special sample of newly created households should be made and recruited periodically. An approximation may be obtained from a sample drawn from marriage lists for the area, selected in the same ratio as the panel sample is to the total population if proportional representation is desired. The new household may then be recruited to the active panel if it is established within the panel area. If a newly married couple does not settle in the panel area no substitute will be made, thus reducing the sample in proportion to the "non-residents" on the marriage lists. Households which are dissolved through death or for other reasons are dropped from the active panel, and these newly created families are added. This reflects the changes in the age and associated characteristics of the population in the panel and keeps the sample as "young" as the population.

Replacements and substitutes for non-cooperators.—The method of replacing those households selected from the sample census which did not agree to be panel members in the initial recruitment has already been discussed. Those which are included in the basic sample but subsequently discontinue cooperation, requiring that they be dropped from both the active and basic panel samples, are to be replaced by households selected from the sample census list—households which had similar characteristics at the time of the sample census. It is assumed that on the average the replacements will have changed the same as the panel members they replace.

---

[5] Needless to say such special surveys would not have to be made very often since the number of families moving into newly constructed homes directly from outside the city would usually be very few and could have very little effect on the total population in most cases. A notable exception would be a situation where a new defense industry were established requiring the building of large numbers of new housing units to accommodate the new workers.

The problem of finding adequate substitutes for newly created families refusing to become panel members could probably best be solved by selecting substitutes from the same lists of couples applying for marriage licenses as the original sample, using age and date of marriage as control factors, since these facts are printed.

There are two practical sources of substitutes for non-cooperative "new from-outside-the-area" households. Those new families moving into addresses vacated by households selected for panel membership, but not in either the first sample or active panel are not to be recruited directly as panel members, since to do so would result in an over-representation of "new from-outside-the-area" families in the panel. Thus this group is one of the possible sources of substitutes for the non-cooperators needed as active panel members. They may be selected on the basis of matching characteristics. If this does not provide a suitable supply of substitutes for non-cooperative "new-from-out-of-the-area" families, the substitutes may be selected from the sample census list on the basis of the characteristics of the panel family which is being replaced. This is based upon the assumption that the families moving into an address will, on the average, be similar to those previously occupying the residence.

Summary

The sampling problem for a continuous consumer purchase panel presents a number of special considerations, including: (1) the panel operates over a period of time and therefore the sampling procedures must be adaptable to changing conditions; (2) the cost relationships are quite different from a single survey; (3) it is impossible to recruit a large percent of the population for panel membership; (4) willingness to become a panel member is not distributed at random within the population; and (5) cooperation is not continuous or ever-lasting.

A brief outline of a sampling procedure designed to cope with these special problems was presented. It is not perfect, since non-cooperators are not included in the sample and the basic tenet of pure theory that all units in the population have the same chance of being included in the sample is violated. The procedure does, however, present a practical means of minimizing the non-cooperation bias making it possible to obtain a sample of cooperators very nearly representative of the population. In addition to the procedure for obtaining a representative panel sample, a technique has been suggested by which the panel sample may be kept representative of the dynamic population. This is accomplished by means of balancing a representative sample of immigrant and of newly created families against a representative sample of emigrant families and families which have ceased to exist.

JAMES DUNCAN SHAFFER

Michigan State College

PUBLICATIONS RECEIVED

*Anderson, Oscar Edward, Jr., "Refrigeration In America," Princeton: Princeton University Press for the University of Cincinnati, 1953, Pp. vii, 344. $6.00.

Bourde, Andre J., "The Influence of England on the French Agronomes," New York: Cambridge University Press, 1953, Pp. xi, 438. $6.00.

Brandt, Karl and Associates, "Management of Agriculture and Food in the German-Occupied and Other Areas of Fortress Europe," Stanford: Stanford University Press, 1953, Pp. xxxiv, 707. $10.00.

Ferber, Robert, "A Study of Aggregate Consumption Functions," New York: National Bureau of Economic Research, 1953, Pp. 72. $1.50.

Harris, Marshall, "Origin of the Land Tenure System in the United States," Ames: The Iowa State College Press, 1953, Pp. xiv, 445. $7.50.

*Huffman, Roy E., "Irrigation Development and Public Water Policy," New York: The Ronald Press Company, 1953, Pp. xi, 336. $6.50.

*Johnston, Bruce F. with Hosoda, Mosaburo and Kusumi, Yoshio, "Japanese Food Management In World War II," Stanford: Stanford University Press, 1953, Pp. xii, 283. $7.50.

*Koenig, Nathan, "A Comprehensive Agricultural Program for Puerto Rico," Washington: U. S. Government Printing Office, 1953, Pp. xii, 299. $1.75.

Murray, William G., "Agricultural Finance," Third Edition, Ames: The Iowa State College Press, 1953, Pp. x, 419. $4.50.

Schulz, William F., Jr., "Conservation Law and Administration: A Case Study of Law and Resource Use in Pennsylvania," New York: The Ronald Press Co., 1953, Pp. xxv, 607. $10.00.

Spencer, William H. and Gillam, Cornelius W., "A Casebook of Law and Business," Second Edition, New York: McGraw-Hill Book Co., Inc., 1953, Pp. xii, 968. $8.00.

Statistical Statements Relating to the Co-Operative Movement in India for the year 1950-51, Bombay, India: Agricultural Credit Department Reserve Bank of India, Bombay, India, 1953, Pp. vi, 97. Rs. 3.

Thompson, James H., "Markets and Marketing Methods of the West Virginia Coal Industry," Morgantown, West Virginia: West Virginia University, 1953, Pp. 15.

Woytinsky, W. S. and Woytinsky, E. S., "World Population and Production, Trends and Outlook," New York: The Twentieth Century Fund, 1953, Pp. lxxii, 1268. $12.00.

Young, Robert J. and Marshall, Hubert, "Public Administration of Florida's Natural Resources," Gainesville, Florida: Public Administration Clearing Service, University of Florida, 1953, Pp. ix, 257.

---

* Reviewed in this issue.

BOOK REVIEWS

Irrigation Development and Public Water Policy, Roy E. Huffman, New York: The Ronald Press Company, 1953. Pp. xi, 336. $6.50.

This book is destined to become a standard reference on the economics of irrigation. Being basically a review of the literature in this field, it will serve as a handbook of facts and issues for students of irrigation. It is not a blueprint for public action. The reader learns a great deal about irrigation problems but finds only the broadest suggestions about what could be done to revamp water policy. And this is clearly all that was intended in the preparation of this book.

Reactions to this work will vary according to the readers' conceptions of what data are important and how they should be interpreted. The "conservancy district" idea, for example, receives scant attention despite the fact that there are many who regard it as one of the promising avenues to regional analysis and planning. All could agree, however, that the literature has been rather thoroughly explored and that the outline followed is a good one. And those in particular who are familiar with basic difficulties in water policy will use the book effectively in college courses on the subject of irrigation. But there will be others who would have preferred a less "objective" treatment.

Quite apart from his accomplishments in handling the subject matter, Dr. Huffman should be commended for his courage in attempting a work such as *Irrigation Development and Public Water Policy*. For anyone who has tangled directly with the treacherous stream of water policy during the past fifteen years might well throw up his hands in disgust. Dr. Huffman points out, for example, that: "There are few public issues which are the target of more shallow thinking and more biased discussion than the administration of resource development. Most politicians and most organizations cannot come within gunshot of the subject of resource development without making statements and passing resolutions for or against the pattern of interagency committees and for or against valley authorities" (p. 166).

Feeling as he does that it is unlikely that any single plan could serve more than one river basin, the author provides what he considers the relevant data from which particular plans must evolve. These data have been selected under 14 main headings, ranging from population projections to problems of the business cycle, foreign trade and national security as they relate to public investment in water resources. His concluding chapter, "Toward a Sound Irrigation Policy," contains a list of 20 propositions which he believes are important components of a sound irrigation policy. The nature of these propositions can be made clear by quoting the first

two: (1) "Population trends in the United States indicate that a reappraisal of the nation's food and fiber needs is in order. . . . (2) The development of some new lands may be necessary to the increased efficiency of some segments of agriculture." (p. 304).

It is interesting to note that the author begins his treatise by emphasizing that there has been a significant change in our thinking regarding the place of socio-economic aspects of water problems but leaves it to the reader to assess the effect of this change. What is the evidence of such a change? Is it to be found in the so-called economic studies of specific irrigation projects by land-grant colleges? In the endless series of projections of costs and benefits, including the multiplier effects of intangible benefits? Possibly. But the author concludes that "the United States has never had a consistent policy for irrigation development. The most convenient and best selling arguments have been used from time to time. Such an opportunistic approach has largely eliminated long-run goals from public action. Policy has borne little relationship to the needs of the nation" (p. 302-303). One must conclude, therefore, that the shift in thinking has produced little more than intangible benefits.

A significant step in correcting this situation, however, has been taken by the publication of this book. Few people could have done as well as Dr. Huffman in painting the backdrop against which an improved water policy may eventually be staged. But it is equally clear, as Huffman points out, that we must become more rational about planning if a well integrated public water policy is to be developed. This is not exactly the direction of national leadership at the moment.

Need we be reminded that the prospects for national planning are not exactly bright? Need we be reminded that even the T.V.A. is no shining example of a passion for planning the development of a river basin's resources? Hardly. But it is in relation to the growing antipathy toward the planning concept that the real significance of Huffman's book may be seen. For if we are ever to come of age in this matter we must first become aware of the alternatives open to us. I hope, therefore, that this book finds an audience sufficiently broad to redirect our thinking along more constructive lines.

B. H. KRISTJANSON

North Dakota Agricultural College

The World Wheat Economy, 1885 to 1939, Wilfred Malenbaum, Cambridge, Massachusetts: Harvard University Press, 1953. Pp. 262. $6.00.

The purpose of this book, in the author's words, is "to isolate the fundamental factors which explain . . . prewar [World War II] developments, . . . which contribute to the balance—or more appropriately, the lack of

balance—between demands and supplies of wheat. While the book touches only briefly upon the present and prospective wheat position in the world, it sets the stage on which these future developments can be expected to appear" (p. viii). Details are avoided and instead a macroscopic treatment is used in analyzing long-period movements and their interrelationships. It does not attempt to provide an aid to year-to-year decisions of individuals or groups of individuals in production, but rather it focuses attention on and facilitates the development of sound long-run national or international policies and programs.

The study reveals that from 1900 to 1939 wheat supplies progressively exceeded the growth in demand for wheat for human consumption. The analysis indicates that adjustments in the acreage of land devoted to wheat production would have been a primary remedial measure. For this measure to have been effective adjustments (reductions) were needed particularly in the large exporting countries. Attempts to solve the problem by international agreement could not be initiated or were inadequate. The specter of "surpluses" appears to be rising again after a period of relief in the 1940's.

Malenbaum shows that there is no significant trend upward or downward in the per capita human consumption of wheat in the "world" as a whole. (Some countries were excluded because of lack of comparable or adequate data and for other reasons.) The consumption per capita declined noticeably in the overseas exporting countries and increased in other exporting countries and non-European importing countries. The decrease in per capita consumption in the overseas exporting countries was related to a high level of living and changes in diets from starchy foods to meats, fruits and vegetables. In the European countries wheat has been substituted in part for other starchy food—particularly potatoes and rye. There is some preference for wheat as the level of living moves upward from an extremely low position. The opportunity to expand per capita consumption appears greatest in such countries if the level of living could be raised. The demands for wheat for feed and other uses in the United States is more elastic than for direct human consumption. However, according to Malenbaum there has been a general prejudice against wheat as feed. "World" population increased 50 per cent from 1885 to 1939.

The annual production of wheat increased about 75 per cent during the 55 years included in the study. Most of this increase was due to expansion in acreage. While there has been expansion in acreage in most of the exporting countries and some importing countries, the major expansion has been in new areas or countries: Argentina, Australia, Canada and the United States (and Russia). Malenbaum found some short-run produc-

tion responses to prices and income. However the major expansions appear to be related more to population growth, immigration, railways or those factors, including lower cost of production, associated with people settling and developing new areas.

With hungry people in the world there is the possibility of increasing the per capita consumption of wheat. The increase will depend largely on foreign assistance programs. Also, such increases may be offset by decreases in other countries. No large, new areas are available in which the acreage of wheat may be expanded. However, there is evidence that production can continue to expand through higher yields. In fact production in the important exporting countries in the postwar period was well above the immediate prewar years (United States, 50 per cent). Consequently a "surplus" problem is likely to exist.

The author pointed out difficulties in obtaining international agreements to solve the long-run problem. The U. S. may have to devise its own means for controlling production, particularly if a "high" price of wheat is maintained. Further examination of state management and duopolistic (United States and Canada) and related conditions in foreign trade might have shed some additional light on the subject. Additional consideration might have been given to the effects of freeing the various economies from protections, supports and other national programs. Admittedly it would have been largely hypothetical. The fact that demand is elastic for the individual wheat producer and inelastic for the industry should be observed in developing national policies and programs.

The study might infer that wheat farmers have not fared well in the past and that future prospects are not bright. Further analysis of costs of production might modify such conclusions. The possibility of expanding significantly the use of wheat needs additional consideration. Low costs might permit wheat prices to be comparable with other livestock feeds allowing for "prejudice," if such really exists against wheat.

The analysis is concise and presented in a clear and straightforward manner. It will be of particular interest to students in marketing and consumption economics and to all persons who might be concerned with agricultural policies and programs. The book is Volume 92 in the series of Harvard Economic Studies and the study was awarded the David A. Wells prize for the year 1942-43.

WILFRED H. PINE

Kansas State College

E. A. Stokdyk—Architect of Cooperation, Joseph G. Knapp, Washington, D.C.: American Institute of Cooperation, 1953. Pp. 229. $3.00.

This book is essentially a biography of E. A. Stokdyk with emphasis on

his professional work as an agricultural economist, university professor, and president of the Berkeley Bank for Cooperatives.

The purpose of the book is set forth by the author under the heading, "A Personal Word" as follows:

"Who was Stokdyk? What was he like? What did he stand for? Why is he important? This volume attempts to answer these questions. It is based on the record of what Stok . . . said and did, and on the memories of those who shared life with him. . . . This, then, is really the object of this book: to capture some of the spirit, charm, and purpose of this unique personality so that we may get the full benefit from the lessons of his life."

To accomplish this purpose the author takes us quickly through Stokdyk's youth and then devotes a chapter to each major phase of his life. The organization is changed somewhat toward the latter part of the book. Rather than continuing in a chronological order, these later chapters are devoted to major areas of Stokdyk's work. There are chapters on "The Prorate Experiment," "The Law of Cooperative Marketing," "Cooperative Educator," "Financial Statesman" and "Cooperative Spokesman."

Because these contributions overlapped as to time, this shift in organization makes it possible for the reader to get a clear-cut picture of the contributions in these specific areas. The last chapter is essentially an appraisal of Stokdyk. In this chapter, perhaps even more so than elsewhere, the author quotes the opinions and observations of numerous men who lived and worked with Stokdyk.

In addition to the story and appraisal of Stokdyk's life, the book contains twelve talks and articles written by Stokdyk. Finally, the book contains a complete bibliography of the writings of Stokdyk from 1921 to 1946.

In his "A Personal Word" the author states ". . . To read these essays with the fullest appreciation and enjoyment one must know this man as some of us were privileged to know him." Fortunately, this reviewer knew Stokdyk, but unfortunately, not nearly so well as the author. Therefore, any observations or judgments as to emphasis or overall thoroughness of the book must be made with this handicap and consequently with reservations.

For the most part the book is well written and reads easily. Stokdyk is presented as an able scholar and administrator with the knack for getting things done, yet a person who loved to tell a story and was the life of the party. That his personality was unique is beyond question. Perhaps others of us would find our educational efforts more productive if we possessed his ability to get along with and influence people.

But somehow the picture of the man presented in the book seems too good. Did not the man have any weakness nor were there no failures?

Normally, these are a part of every man's life and it is the rising above them that contributes to his greatness and are the important "lessons of his life." To this reviewer this omission, if it is an omission, is the principal criticism of the book. Another is that the copious quotations of friends and associates sometimes result in duplication and repetition.

This book is and will be a prized possession of the family and friends of Stokdyk.

To the agricultural economist it is a story of how a successful member of his profession contributed to knowledge and public welfare. There are many good lessons in it. These include such diverse things as: how to go about research, particularly in a new field; how to write well and the desirability of publishing your ideas; how to get along with and influence people; and how to organize an administrative unit. Furthermore, there is historical information on marketing and cooperation that many should find valuable.

The economist who works in the field of farmer cooperatives and the managers and other leaders of farmer cooperatives will find the book most useful. There are many good principles and ideas about cooperatives throughout and particularly in some of Stokdyk's writings which are reproduced in the book. He was president of the Berkeley Bank for Cooperatives. As a consequence, the book includes his ideas on sound financial arrangements for farmer cooperatives with particular emphasis on revolving plans. Included among his writings are short discussions entitled, Sound Cooperative Principles," "Powers and Duties of Boards of Directors of Cooperatives," "Trends in Agricultural Cooperation," "A Charge to the New Director" and "Financial Structure and Policies of Cooperatives."

Finally, the author is to be congratulated for his work in writing this book without compensation. Would that there were published records of the life and works of other great agricultural economists.

G. W. HEDLUND

Cornell University

Brot für ganz Europa (Grundlagen und Entwicklungsmöglichkeiten der europäischen Landwirtschaft), Fritz Baade, Hamburg & Berlin: Verlag Parey, 1952. Pp. 230. DM 24.–.

This book by the eminent German agricultural economist is most interesting because it presents a certain pattern in achieving a European economic unity by increased agricultural production and integration of agricultural markets. Dr. Baade is well acquainted with various types of rural economy in Europe because, in addition to agricultural work in Germany, he spent twelve years in Turkey during the Hitler regime. At present he is teaching agricultural economics at the University of Kiel, where

he is Director of the Institute of World Economics. Baade also takes part in the political life of Germany as national deputy of the Social Democratic Party in the Bundestag.

The central theme of this book is that Europe—either as Western Europe or Europe including Britain and the Soviet satellite states—could reach an agricultural self-sufficiency in two decades. The tendency of an increased ratio of the agricultural production to the population in Europe became noticeable in the period between both world wars. Baade considers that the application of commercial fertilizers was the most important factor in the reversal of Malthus Law causing the upswing of agricultural productivity. The relationship between crop yields and fertilizers is illustrated by several interesting charts, which show their close correlation in various European countries. A panoramic survey of rural structures from primitive Balkan villages to modern German farming shows differences among countries.

Baade's intention is to raise the standard of European consumption of agricultural products to levels approaching those in the United States and he often makes comparisons with this country. Heavier application of fertilizers would make it possible to achieve a one-third larger agricultural output on the same acreage in Western Europe and feed ten per cent more people in 1970 than today. An application of 40 kg N, 40 kg P_2O_5 and 60 kg K_2O per average hectare would be necessary for this purpose. This production could make Europe independent from practically all agricultural imports, particularly grain and meat. Baade believes that agricultural surpluses of the United States and other overseas countries could find markets in Asia and Africa instead of in Europe, because the Malthus Law would rule there further.

The specific reasoning of Baade's idea of a European "agricultural self-sufficiency" is not clear and it is questionable whether it is possible or desirable for world economy. It is rather difficult to imagine that in the future "United States of Europe," when custom barriers will be abolished, national economic policies could completely disappear as in the "states" of the United States. It can be presumed that the industrial countries in the confederation of the "United Nations of Europe" would search the markets not only in the agricultural regions of Europe, but also overseas; thus, an exchange of industrial and agricultural products would follow. The European agricultural surplus-regions might find also some partial markets in Asia and Africa, just as well as the United States.

Concerning Eastern Europe, Baade regards the collectivization of agriculture as the only reason for low productivity. In addition to this factor, the lack in application of fertilizers and manures on some crops, particularly on grains, potatoes, meadows, and pastures, should have been

stressed. However, it is noticeable that crops (cotton, sugar beet) on which fertilizers were applied in the Soviet Union showed a considerable increase of yields in the last years before World War II.

Increased agricultural productivity could be easily obtained in many countries by heavier fertilization; however, the propensity to consume fertilizers usually follows the level and the changes of agricultural income. Baade to some extent regards the fertilizers as an instigating factor ahead of the agricultural income, and the consequence of fertilizers will be the increased agricultural purchasing power. In the long-run analysis he considers the principle of diminishing returns as economically inoperative in a whole country owing to tremendous possibilities of fertilizer application by increased rates and in new areas. However, at the time of application of fertilizer, a farmer has to know exactly the physical rates of fertilizer which his soil permits and the ratio between fertilizer costs and agricultural prices to obtain highest yields at least costs. In this respect, the "equations" of Mitscherlich, Spillman, Crowther, and recently of Ibach and Mendum are most valuable showing soil or market limitations to the trend of increasing agricultural productivity. It is true that the limitations in the law of diminishing returns are not static and a progressive economy operates by continuous shifts upwards.

Baade's book contains rich material on the development of European agriculture between both Wars, during World War II and the aftermath. A valuable contribution of this work consists in constructing a commercial fertilizer policy for the economy of a whole continent; this has often been neglected by economists and economic policies of many countries.

MIRKO LAMER

Washington, D.C.

A Comprehensive Agricultural Program for Puerto Rico, Nathan Koenig, Washington, D.C.: U. S. Government Printing Office, 1953. $1.75.

Puerto Rico's dynamic and successful industrialization program, well-known among students of economic development, has drawn attention away from the possibilities of increasing the island's income from agriculture. The Koenig report should help assure that the industrial development is not emphasized at the expense of improvements in the agricultural sector.

The author, assistant to the U. S. Secretary of Agriculture, is unquestionably justified in his use of the term "comprehensive" in the title report. Beginning with chapters entitled "The People and the Land," "These Are the People," and "This Is the Land," he moves through the topics of soil erosion, water resource use, forestry and tree crops, utilization of grasslands, land reclamation, agricultural credit, production potentials,

marketing, and land tenure and tax policies, giving meticulous attention to details within each of these problem areas. For example, about five pages in the chapter on the use and control of water deal with wildlife and recreation, detailing the waterfowl and dove census as well as recent hunting and kill data.

Much of the report, of necessity, must be a rather dreary recitation of exploited land and unexploited production opportunities. With the island's famous population density at 645 persons per square mile in 1950, it is little wonder that the economy's agricultural sector is deserving of study. Crops are attempted on even the worst land; cultivation practices mine the soil, yields are low, agricultural credit is limited and the marketing system provides inadequate incentives for the production of many crops. Were these matters improved, Koenig estimates, the farm value of agricultural output could be increased by about 73 per cent. This foregone production is particularly painful to contemplate in view of the low standard of living of the rural Puerto Rican.

The island's agricultural problems, major and minor, are carefully reviewed. Clean-cultivated crops are grown on steep mountain slopes with no attempt to prevent soil erosion. This leads not only to deterioration and eventual abandonment of the land but also to sedimentation of the island's reservoirs, so vital to water control. (Sedimentation over a 37-year period has reduced the capacity of one reservoir by an estimated 70 per cent.) Present irrigation methods, which in many areas allow almost three-fourths of the water delivered to leach away, should be improved. The island has been stripped of many of its forests; reforestation and better management of the remaining forests would not only minimize soil erosion and reduce the possibilities of downstream floods but would increase island income from wood products and reduce the volume of imports of these goods. Grassland practices leave much to be desired. And the marketing of agricultural products in Puerto Rico, as in other agricultural underdeveloped areas, takes place without the benefit of packing or grading, adequate price information, rapid movement to market, or refrigeration.

One of the greatest obstacles to the development of Puerto Rico's agriculture is the strong allegiance to sugar cane. Just as cotton had a stranglehold on the south for many years, so the devotion to cane in Puerto Rico has slowed the desirable diversification of agricultural production. This fixation is evidenced not only among the growers but among the bankers, the agricultural credit organizations, and the agriculturists of the Commonwealth government as well. Koenig here makes a valiant attempt to correct this bias in production and policy. His recommendations are aimed primarily at diversification of agricultural production.

This report does not go as far as it might toward providing the Department of Agriculture of Puerto Rico with a "comprehensive agricultural program." The book is directed not only to the agriculture policy-makers of the Commonwealth government but also to the person totally ignorant of the island. The first forty-five pages are devoted to background material which must surely be familiar to the men who have been wrestling with policy for some years. Furthermore, chapters dealing with specific aspects of the island's agriculture are written on the presumption that the reader is a total stranger to the Commonwealth.

This would not be a valid objection, of course, if the book were also designed to fulfill the needs of the policy-makers. While it does provide an exhaustive compilation of Puerto Rico's problems and a list of policy recommendations a second volume, or at least an extended appendix, appears necessary. The Department of Agriculture of Puerto Rico faces another problem which the Koenig report scarcely mentions, namely that of the priority of programs and the allocation of funds.

The administrative problem of deciding how best to allocate limited funds among numerous alternative programs is one on which advice would be welcomed. The report indicates the attainable annual farm value of various crops and livestock products compared with 1950-51 farm value. The next step is to estimate the cost, to the Commonwealth government, of increasing the production of each of the agricultural products up to the attainable level. There are surely significant differences among crops as to the increase in farm value which might result from an additional $1000 spent by the Department of Agriculture in promoting better farming practices. For example, the expansion of oranges or pineapples, is hampered by inadequate marketing facilities, whereas this barrier does not appear to exist for other crops, such as coffee. Presumably the increase in income resulting from a given expenditure of government funds would be greater in the latter case. Analysis leading to a priority list of programs must be performed by someone if an optimum use of government funds is to be approximated. It is a difficult but an essential task.

Implementing the policy proposals would seem to deserve special attention in view of the charge that the Commonwealth's Department of Agriculture is long on planning and short on execution. Perhaps the limitation of funds accounts for part of this, but there must be additional administrative difficulties which should be investigated. If implementation is a greater problem than planning in Puerto Rico, someone must produce a second volume to this work; else the value of the Koenig report may be lost.

In summary, the Koenig report is a detailed supplement to the discussion of agriculture in Perloff's *The Economic Future of Puerto Rico.*

It will be useful for many people, but it stops short of answering a whole series of important questions which must be answered before a worthwhile program can be established.

RICHARD H. HOLTON

Harvard University

What Our Farmers Can Learn From Other Lands, Ralph S. Yohe, Ames, Iowa: The Iowa State College Press, 1953. Pp. 164. $3.00.

This book will serve a useful purpose by arousing interest in foreign agriculture. It will impress readers with how different our agriculture is from that abroad, and with how much we could learn from the experiences of many centuries. Certainly it will cause the American reader to be more thankful for his citizenship in the United States. Possibly it will encourage him to do more than his own part to maintain America as "the land of opportunity."

The author well describes a wide diversity of important agricultural conditions and problems in thirteen countries from Norway and Sweden to Turkey and Israel, including the Netherlands, which the author inaccurately calls Holland. Some of the observations probably are not ones other travelers would consider especially important, but this is to be expected. Summaries are given in italics of observations or conclusions the author believes to be of special importance to American farmers. Among these statements the following thoughts are expressed: mass education of peoples is needed for prosperous agriculture; our agricultural extension service should be kept entirely separate from and independent of government regulatory agencies; yields of crops are very high in some countries—much higher than in the United States; and the greatest frontier for American agriculture is to make every acre count, to increase yields and in this way to make every acre become larger.

The future prosperity of many of our farmers will depend, the author states, on how soon they learn the lessons Swiss farmers learned and solved long ago with trees, grass and livestock. One chapter is titled "Forests—Our Neglected Income" and describes some Norwegian forestry practices. Problems of land ownership, inheritance of land and tenancy are discussed with relation to conditions in several countries. Some readers will disagree with the author's statement, "The first lesson that I learned in Europe was that a prosperous agriculture depends on an ever-expanding economy." Definitions are important in this observation, which follows descriptions of farms in Egypt and Italy where living levels are very low, non-agricultural employment is almost non-existent for farmers, and where there is excess population trying to survive on the land much as their ancestors did three thousand years ago. The discussion of control of livestock diseases points out that we are far behind some of these coun-

tries in eradicating disease. Drawing more on United States experience with crop improvement than on European practices, the author indicates our need for new and more types of livestock, better adapted to widely differing conditions in the United States. However, France is not mentioned as having gone to the other extreme with thirty-one recognized breeds, several of which are inferior.

The author does not fully recognize one fundamental difference between American and some European agriculture; namely, that where land is definitely the scarce factor of production the objective is to maximize returns to the land. This accounts partially for very intensive cultivation of every square foot of land and for the large production per hectare in some countries.

This reviewer believes the author is prejudiced in his appraisal of government activities in these countries. He does not adequately point out the relatively high level of living (all circumstances considered) in the northern European countries and British Isles having the most complete government programs. He is critical of the Norwegian milk monopoly which sells high quality, pasteurized (but not homogenized) milk only through stores at a relatively low price per liter to a people who consume much more milk per capita than we do. The statement, "Here in America we like competition," (p. 40) would be more accurate if the words, "for the other fellow" were added.

The author emphasizes the large degree of control and the undesirability of it, whereas this reviewer, partly as a result of discussions on the subject with Europeans and British, believes there are two basic lessons to be learned. One is how best to use government, if we must move that way. The other, and more important for us now, is consideration of the factors which influenced these extremely freedom-loving peoples (Dutch, Norwegians, Swedes, Danes and English) to hand control and ownership of important segments of their economies over to their governments. Powerful forces, which these peoples believed could be controlled best by expansion of government control and ownership even though it meant sacrificing some of their own liberties, when operating in the United States can probably be expected to cause citizens in our country to adopt similar control methods. The author names some of these forces in one short paragraph (p. 69), but he devotes pages to examples of government control and ownership and their undesirable effects. The author and reviewer agree that much should be learned about these problems before the "land of opportunity," as young people abroad think of the United States, matures its political and economic systems to ones like some of those abroad.

This reviewer questions why some other very important lessons to be

learned abroad were not mentioned—if but briefly. Prominent among them are the effects of wars on agriculture; and the limited resources which together with large populations, mean very limited resources per capita. Especially noticeable are the results of small and limited trade areas, each protected with effective barriers to hamper trade among the countries, to limit markets and employment, to keep living levels low and to make the desirable objective of a United Europe very difficult to attain.

HAROLD F. HOLLANDS*

Oregon State College
Corvallis, Oregon

Refrigeration in America: A History of a New Technology and Its Impact, Oscar Edward Anderson, Jr., Princeton University Press (for the University of Cincinnati), 1953. Pp. ix, 344. $6.00.

"Demand creates its own supply." One of the most convincing demonstrations of this economic saw is in the history of refrigeration in this country, as presented by Anderson. The book covers more than merely the economic dynamics involved in the development of a technology. But readers who are not engineers will probably find the illustrations of economic dynamics of greater interest than those of the intricacies of mechanical developments in the refrigeration process.

In 1806 the practice of refrigeration was already so specialized that an enterprising Boston Yankee shipped a cargo of ice to Martinique: domestic inter-regional trade in ice, based on sea transport down the Atlantic Coast, began even earlier. This trade stimulated an informal international program for the exchange of information: "not long after Americans demonstrated the practicality of exporting ice, . . . Norwegians visited the United States to learn American methods of harvesting, storing, and shipping . . . [by the mid-1800's,] Americans were compelled to withdraw from the English trade by Norwegian competition." Previously, "Massachuetts firms [had] shipped to England and for a while controlled the London market."

This trade and most of the refrigeration for half a century thereafter were of course based on natural ice. This dependence of supply upon climate made ice very expensive in our southern states, particularly at points removed from water transport. And even in the North, domestic use of ice was exceptional. Nor was the industrial or commercial use of ice commonplace.

Although use of refrigeration in the mid-19th century was not diffuse, at about that time some of the demands for practical refrigeration systems

* Dr. Hollands worked on the food and agriculture program in Western Europe for three years with ECA and MSA.

became more insistent. These demands, which found their expression mainly in the food and related industries, could be attributed to (a), increasing urbanization and industrialization, which required the shipment of food from afar, and (b), rising real standards of living, which induced year-round interest in a greater variety of foods than those available in imperishable (and often unpalatable) forms.

The first of these pressures was even stronger abroad than in this country, with England separated by an ocean from her meat supply. Therefore, it was not surprising that many of the early industrial applications of mechanical refrigeration were made abroad. Most American practice until well after the Civil War was based upon European design.

Meat packing and brewing were the U. S. food and beverage industries whose requirements provided the greatest stimuli toward improved refrigeration. The first was especially active in developing a practicable refrigerated railroad car, which permitted location of slaughterhouses at points removed from consuming centers. At the same time, the refrigerated car relieved certain limits upon urban growth as still existed in 1853, when more than half of New York City's fresh milk supply depended upon "mash-fed cows [stabled] in the heart of the city."

Although mechanical means for production of cold became increasingly important in industrial applications from about 1870 on, household refrigeration continued dependent upon ice, natural or manufactured, for more than a half-century further. The successful automatic operation of a mass-produced household refrigerator was not a reality until the 1920's. By 1930 annual sales of mechanical household refrigerators exceeded sales of ice refrigerators. The continued development of economical electrically-powered units for commercial installations has cut further into the demand for water ice. The author holds that it is these facts of greater economy and convenience, plus requirements for sub-freezing temperatures, that principally explain the competitive decline of ice as a refrigerant, although "the iceman, who had become a national joke, was responsible for much of the dissatisfaction occasioned by the use of his product. . . ."

Refrigeration in America is a refutation of the idea that a doctoral dissertation must be dull and staid. True, this review has selected highlights for discussion, but by no means all of the highlights. Aside from his painstaking research among facts which are for the most part quite interesting, Anderson has linked the developments in a cause-effect, stimulus-response alignment that contributes to an understanding of how a situation came to pass. In return for these benefits, this reviewer is inclined to be charitable about the incessant citing of sources and a slight degree of repetition in the text.

EDWARD KARPOFF

Bureau of Agricultural Economics

The Farmers' Movement, 1620-1920, Carl C. Taylor, New York: American Book Company, 1953. Pp. vii, 519. $5.50.

Between a short introductory chapter, the title of which alleges "there is an American farmers' movement," and an even shorter summary on "concepts and conclusions," Dr. Taylor presents a 470-page episodic account of organized protest activities by American farmers. The colonial tobacco turmoil, Shays' Rebellion, the Whiskey Rebellion, Fries' Rebellion, Jeffersonian agrarianism, the Jacksonian revolt, and many of the numerous pre-Civil War farming societies and clubs are offered as protest forms of "the farmers' movement" during the 2½ centuries preceding the Grangers. Onward from the 1870's when the hitherto fraternal Grange "almost inadvertently became the mouthpiece of the discontent among farmers," the account deals with organizations and political ventures whose names are quite familiar. Even though many of these were not initially concerned with the issues conceived by Taylor as the peculiar province of the farmers' movement—prices, markets, and credit—they were ultimately forced into them and thus became parts of the movement.

In his preface, Taylor disavows his work as primarily history; rather, he says "it is a sociological analysis of a movement." Yet, before the reader has a chance to get under way, he is thrown into uncertainty by the further explanation that "this book does not so much present a general theory of social movements as a detailed record of a movement. . . ." Perhaps the further explanation that the purpose is to attempt a "laboratory study" should be clarifying; unfortunately, for this reader it was not.

From 300 years of American experience, the author assembles episodic raw material, some in great detail. Published works, newspapers, interviews with farm leaders, and "fugitive" literature of organizations and their leaders were the principal sources of information. The unifying thread for all details was their relevance to the issues of the farmers' movement hypothesis. Nevertheless, as the account proceeds, one becomes somewhat more impressed with the pre-eminent sovereignty of the desciptive details as against the meagerly interspersed "analytic" sentences which are scarcely more than assertions to the effect that the episode under consideration does belong to the farmers' movement.

Taylor reports his hypothesis to have been inspired by Veblen's writings on the evolution of "the price and market regime" and Commons' concept of the American Labor Movement. The most formal statement of Taylor's hypothesis (page 493) is this: ". . . just as all these struggles [over wages, hours, and working conditions] combined constitute the American labor movement, so the various and varying struggles of the farmers arose out of, and have always revolved about, the issues of prices, markets, and credits, and all these struggles combined constitute the American Farmers' Movement."

After all the descriptive materials have been presented, the author

raises a question which gave this reviewer recurring discomfort as he read the book, i.e., "the possibility that the fairly early formulation of the theory or hypothesis [of the farmers' movement] may have served to bias the author in the assembling, selection, analysis, and interpretation of the great and diverse body of information. . . ." Unfortunately, such a hypothesis, though perhaps taxonomically convenient, does have the vulnerability of making similarities, even superficial ones, more impressive than significant differences and contrasts.

In concluding his work, Dr. Taylor seems not wholly convinced that the episodes of farmer revolt have sufficient "sense of group and solidarity" to be a bona fide social movement and concedes that some may argue the negative. Is this really an important question? Is it not more important to ask whether the movement hypothesis is a helpful analytical device? Do we understand farmers' organizations better for having employed this hypothesis? Farm Bureau and Farmers' Union, for example, both have the attributes that would make them part of the farmers' movement. Do we understand either better for having found they have these characteristics in common?

This reviewer would argue the negative. To have analytical value, a concept needs to be definitive in terms of significant criteria. To have found that *some* farmers—poor and not so poor, of many decades, localities, and diverse political inspirations—have had a common desire for better prices, markets, and credits is no more revealing than that the nation's numerous labor unions have always had a common desire for better wages, hours, and working conditions. It is, in contrast, worth while to know *how* each went about trying to realize its objective. This implies analysis not so much of samenesses but of differences and contrasts in the forms of organization, techniques of policy forming, methods of internal government and discipline, and the instrumentalities employed against the external world by which the organization would alter inter-industry relationships. For example, it matters considerably whether a farmers' organization undertakes to alter the terms of trade between agriculture and nonagriculture by crusading for antimonopoly measures against industry or by seeking special dispensation and intervention from government to equalize monopolistic controls. One of the most universally accepted and continuously advocated methods of improving the lot of farmers has been that of specially adapted research and education provided by government —a subject given no consideration in this work. Also, it matters a great deal, in studying organizations, whether a particular policy or position is impressed upon leadership by popular demand or whether it is one to which the membership is persuaded by reason of the power needs of leadership. To make all these divergent objectives and methods seem the same under a single movement hypothesis conceals more than it reveals.

"The farmer" is an expensive myth. Its highest cost has been in obscuring the differences and complexities that cannot legitimately be subsumed under so broad a category. Farm price policy offers an example. The burden on the Treasury of programs undertaken on behalf of *the* farmer is but secondary to the fact that our undiscriminating programs have no brilliant record of achieving their espoused purposes. Our controversial price-support programs were undertaken to alleviate agricultural poverty. The justification of these programs relies on price and income averages that are taken to reflect the situation of *the* farmer. Yet, paradoxically, these programs that are designed to administer to apparent average needs characteristically by-pass, substantially if not entirely, the very farmers who need help and pay off handsomely to those who do not.

This work has value in making conveniently available a great deal of obscure historical detail. We can only hope it will not help to prepetuate an unfortunate myth by seeming to say there is only one farmers' movement grounded on a universal common denominator of interest.

VARDEN FULLER

University of California
Berkeley, California

Japanese Food Management in World War II, Bruce F. Johnston with Mosaburo Hosoda and Yoshio Kusumi, Stanford: Stanford University Press, 1953. Pp. x, 277. $7.50. (One of a group of Food Research Institute Studies on Food, Agriculture, and World War II.)

This book is a useful, if highly specialized, addition to a growing literature on the history of our former enemy's economic preparations for World War II and her successive wartime economic and political adaptions to her crumbling military position. Its author was one of the abler of the younger economists attached to the Supreme Commander for the Allied Powers (SCAP), the Allied supergovernment of Japan during the Occupation. He has made the most of this experience to give his study, within the rather narrow scope which he has delimited for it, a sound base. In addition, close collaboration with two eminently qualified Japanese officials and consultation with several other Japanese, including two outstanding agricultural economists, has assured that his presentation is balanced and rooted in reality.

The book consists of an introductory portion comprising a general statistical description of the characteristics of Japanese agriculture and a detailed review of prewar food production, importation and consumption. The heart of the narrative follows in seven chapters devoted to the deteriorating wartime food situation and government measures to cope with it. The study closes with a chapter on Japan's postwar food shortage and food management under the Occupation.

The approach is historical and chronological rather than analytical and systematic. However, a large amount of analysis and interpretation, reflecting the author's broad grasp of the implications of his subject, is implicit in the selection and arrangement of facts and explicit in numerous short discussions threaded through the study. The book is extraordinarily comprehensive within its defined scope. As a one-volume reference compendium on the subject at hand it will not soon be equalled, either in quantity of detail included or in the care, precision and lucidity with which these details have been brought together.

The job is so complete, in fact, that it seems ungrateful to complain about what is left out. Yet the work as a whole would have been strengthened if an additional chapter had systematically reviewed in one place the analyses scattered through the book to place the Japanese experience in a larger framework from which conclusions could be drawn and lessons learned.

The only real evaluation made is but partly explicit, i.e., that Japan's adaptions to her wartime food problems were as suitable and effective as external circumstances permitted; and the only real conclusion drawn is that Japan is in for a tough time now. This conclusion is no surprise, and elaboration on it is perhaps quite properly the subject of another study. A fuller appraisal of Japan's food policies, however, seems to me to be both germane to this work and of immense importance. The title of the book, after all, concerns food supply management. A major portion of the text is devoted to devices, institutions and techniques of food management, and food production and marketing control. Systematic analysis of the effectiveness of these factors, beyond the fact that while they were in operation so many tons of food were grown, marketed and consumed, would be enormously interesting. A more definite evaluation of the techniques in their Japanese setting versus their general adaptability elsewhere would also be pertinent. Of special interest to this reader would have been a discussion of the political philosophy and long-run economic impact of the quasi-governmental, quasi-private control associations through which the Japanese government worked in almost all phases of food management during the war.

One brief word on style. The book is orderly, lucid, and tightly and cleanly written throughout. The four introductory chapters, however, labor under a massive load of textual statistics. Surely there must be some more palatable way to present the information thus conveyed. Once the real story gets under way in Chapter 6, however, the perspective broadens, the pace quickens, and the details become vital to the narrative. This is no small feat in view of the limited focus and strict discipline of the study, and as one old SCAP hand to another, I salute the author for the success with which he has quelled the urge to write in pure SCAPanese.

DOROTHY C. GOODWIN

University of Connecticut

NEWS NOTES

Richard D. Aplin has joined the University of Vermont as Assistant Agricultural Economist. Aplin did graduate work at Cornell University and the University of California. In addition to teaching Research Methods, he will set up an expanded program of poultry and egg marketing.

George H. Aull at Clemson College has been elected to membership on the Agricultural Board of the National Research Council.

Henry H. Bakken has been promoted to Professor at the University of Wisconsin.

Edward J. Bell is on leave as Administrator of the Oregon Wheat Commission, to be Director of the grain and feed division of the U. S. Department of Agriculture's program of expanding foreign markets, effective December 1953.

A. Dewey Bond has joined the American Meat Institute as Assistant Director of the Institute's Department of Marketing. His activities will extend into the various fields of marketing, statistics and economic research work conducted by the Institute's Department of Marketing.

Howard J. Bonser, of the University of Tennessee, has taken a year's leave of absence for study toward his Ph.D. degree at Pennsylvania State College.

George Brinegar, University of Connecticut, was promoted to Associate Professor as of September 1953.

Dee A. Broadbent, formerly Professor of Agricultural Economics and Assistant Director of the Experiment Station at Utah State Agricultural College, has been appointed Business Manager of the College.

S. Kent Christensen was appointed Assistant Professor in marketing at Cornell where he will concentrate on dairy marketing research.

Robert L. Clodius has been promoted to Associate Professor at the University of Wisconsin.

Irving Dubov has joined the North Dakota Agricultural College as an Assistant Professor to do teaching and research in agricultural marketing. He comes from the University of California.

J. K. Galbraith has been selected Chairman of the Department of Economics at Harvard.

Truman F. Graf has been appointed Assistant Professor at the University of Wisconsin with responsibilities in research and extension in marketing.

Lowell S. Hardin of Purdue University has been awarded an $80,000 research grant by the Indiana Heart Foundation to conduct research on a project entitled "Energy Requirements and Improved Work Methods in Agriculture with Special Emphasis on the Cardiac." He will be joined in this research by specialists in Physiology at Purdue University. The project will continue over a five-year term. The research will attempt to determine the energy requirements, cardiac output, and the physiological values for rural workers doing specific farm jobs under varying conditions.

Peter L. Henderson joined the staff of Virginia Polytechnic Institute on July 1, 1953, as Associate Agricultural Economist. He will do research in apple marketing for the Virginia Agricultural Experiment Station. Dr. Henderson comes from Cornell University.

Richard Holton, formerly of Ohio State University, joined the Harvard faculty in September as Assistant Professor in charge of the undergraduate and graduate work in marketing.

Sidney Hoos of the University of California spent the autumn semester as a visitor at Harvard.

John A. Hopkin is now on leave from the University of Wyoming to finish studies leading to a Ph.D. in Agricultural Economics at Iowa State College.

Robert C. Jones has left the United Nations for Mexico to start a private practice in socio-economic technical assistance.

Quentin W. Lindsey, formerly Project Leader for the Southeast Land Tenure Committee, joined North Carolina State College in July 1953.

Benjamin F. Morgan, Jr. resigned from Virginia Polytechnic Institute to accept a position as Manager, Tri-State Milk Producers Association, Bristol, Virginia.

William H. Nicholls of Vanderbilt University has been granted a leave of absence until September 1954 to accept a staff position with the President's Council of Economic Advisers, Washington, D.C.

Horst Von Oppenfeld, who completed his Ph.D. degree at Cornell University, received an appointment in the Department of Horticulture at Michigan State College where he will carry on research in merchandising flowers.

Loris A. Parcher returned to Oklahoma A. & M. in September, following a year's leave in graduate study at Texas A. & M.

E. A. Perregaux returned to his duties as Head of the Department at the University of Connecticut on September 16, 1953, after serving as Chief of the Food and Agricultural Division, F.O.A. Special Mission to France since December 1950.

Jerold F. Pittman has been appointed Assistant Agricultural Economist at the South Carolina Experiment Station succeeding C. L. Crenshaw, who resigned to accept a position with the Crop Reporting Service in Florida.

Norman K. Roberts, formerly with the University of Hawaii, has been appointed Assistant Economist at the Florida Agricultural Experiment Station.

Willard D. Schutz has joined the North Dakota Agricultural College as Research Assistant, engaged in land classification and appraisal for tax assessment purposes. This work is carried on under a special appropriation by the State legislature under a long-range project designed to lay the foundation for reorganization of rural tax assessment procedures. Schutz was previously with the President's Missouri Basin Survey Commission.

Sol Sinclair of the University of Manitoba, spent the summer months in the Canadian Atlantic provinces on a special investigation of fishery statistics. His report to an Interdepartmental Committee of Fisheries and Statistics of the government of Canada will form the basis for a revised statistical service for Canadian fisheries.

Eldon D. Smith has been appointed Assistant Economist at the Florida Agricultural Experiment Station. He recently completed all requirements of the University of Wisconsin for the Ph.D. degree.

D. Woods Thomas joined Purdue University on January 1, 1954, after having completed the Ph.D. degree at Pennsylvania State College. He will be teaching and doing farm management research at Purdue.

Frederick L. Thomsen has been employed to make a job analysis of the marketing of cattle from Arizona and to outline projects that will have the support of producers and which, when consummated, may be expected to reduce the costs between the producer and consumer.

John F. Timmons of Iowa State College was a member of the United Nations

Staff at the Latin American Land Problems Seminar held at Campinas, Brazil during May and June of 1953.

William D. Toussaint, formerly a graduate student and cooperative agent of the USDA at Iowa State College went to North Carolina State College in January 1954.

Martin V. Waananen from the University of Illinois and a graduate of Michigan, is working in vegetable marketing at the University of Arizona.

Howard S. Whitney returned to Oklahoma A. & M. in September following a year's leave in graduate study at the University of Chicago.

J. C. Williamson, Jr., formerly with TVA and more recently a graduate student at the University of Chicago, joined the staff of North Carolina State College in August 1953.

Homer Woodward, Assistant Agricultural Economist, Maine Agricultural Experiment Station, has resigned to accept a position as Postmaster at Newport, Maine.

BULLETINS RECEIVED

To better provide for coverage of writing in agricultural economics, the *Journal* plans to include a Bulletins Received section starting with the May issue. Department heads, bureau chiefs and others have been asked to set up procedures whereby, beginning January 1, 1954, printed college bulletins, nonrecurrent Government bulletins (primarily Agriculture and Interior) and Congressional Hearings will be sent to the *Book Review Editor, Harold Halcrow, University of Connecticut, Storrs, Connecticut.* This will not include such recurrent reports such as *Agricultural Economics Research* or the *Situation* reports.

To include all mimeographed materials would seem to add many titles of little general or long time interest. A few such materials, and an occasional article from special station journals which are basically professional but of limited circulation, may be forwarded if they appear to be substantive, significant and not normally called to the attention of the profession through regular professional Journals.

The list will include only items published in the United States. From this list a few will be selected for review from time to time. The cooperation and suggestions of the members are invited as this trial proceeds.